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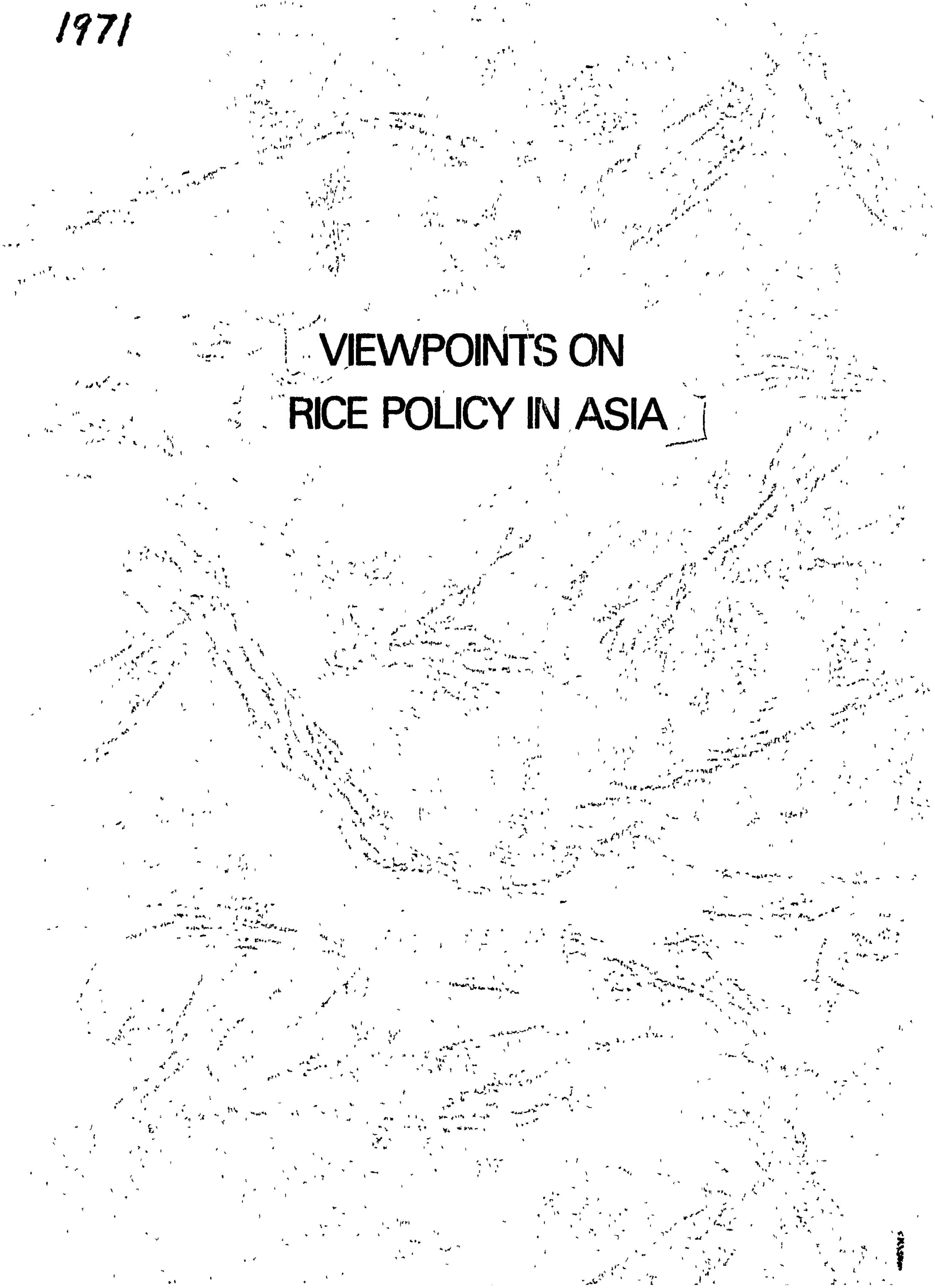
VIEWPOINTS ON RICE POLICY IN ASIA



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PREFACE

This volume contains a series of papers all but one of which were prepared for the ~~Rice~~ Policy Conference held at the International Rice Research Institute, May 9-14, 1971. The first paper by Ruttan presents a summary of the discussion that took place at the conference. The remaining papers with the exception of those by Abel and Easter and by Cochrane, deal with rice policy in several of the major rice growing countries of Asia.

The paper by Abel and Easter differs from the rest in that it proposes a framework for agricultural policy and program planning. The paper by Cochrane, although not prepared for the conference, is included because it suggests needed changes in U.S. policy as a result of the increasing food grain production in Asia and other parts of the world.

The papers by Hayami on Japan and by Lee on Taiwan emphasize the historical evolution of rice policy. Of particular interest is the contrast between the pre-war and post-war policies that have led to current surpluses in Japan. Several other country papers provide information on the current problems encountered in increasing rice production. Taken as a group, these papers suggest that there is still much work to be done in the development and dissemination of technology suited to local conditions. India is a notable case in point, and Narain writes that "the impact of the programmes to increase the production of rice, however, has not been much in evidence so far, 1970-71 being the first among recent years when a significant increase of about 2 million tons is expected."

Some countries are having to reconsider current policies due at least in part to the impact of the new rice technology. As a result of increased world supplies, Thailand must reevaluate its use of the export premium or tax as a bargaining tool in international trade. With the exception of West Pakistan, no country yet has achieved a large enough magnitude of increase in production to seriously reduce domestic rice prices. But the Philippines, which has gained a measure of self-sufficiency, is already considering the problems of diversification.

This limited addition of the papers of the Rice Policy Conference has been prepared in multilithed form so that the information could be available as soon as possible to those interested in current rice policy issues. The papers are presented as prepared for the conference and have not been edited.

Randolph Barker

The International Rice Research Institute
August 1971

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RICE POLICIES IN THE 1970s: A PERSPECTIVE ON THE IRRI CONFERENCE

Vernon W. Ruttan *

Introduction

What rice policies are currently being pursued by the rice producing countries of Asia? What are the policy implications of the rice problems these countries are facing, or will be facing in the near future? What policy options are open to governments in the region? What research related to rice policy issues is now being done, and what are the priority areas for policy or policy related research? These were the questions which provided a focus for a conference on rice policies held at the International Rice Research Institute (IRRI) in May 1971.

The conference was attended primarily by economists who are engaged in research related to rice policy or who are directly making policies. There was also participation from members of other social science fields, particularly sociology and communications. A number of IRRI staff members from agricultural science disciplines related to rice production also participated in one or more of the conference sessions. (A list of conference participants is appended to this conference summary.)

During the first day of the conference, IRRI staff members reviewed their approach to research on rice problems, particularly those of rice production, and outlined the current status and potential developments in rice production technology in Asia. On the second day, the participants discussed policy issues related to farm resource utilization and the distribution of the benefits of new technology. The third day focused on the modernization of rice processing for domestic consumption and for export. The last day of the conference dealt with issues related to price and fiscal incentives for agricultural production and economic development. On the afternoon of the third day, participants visited rice milling facilities, irrigation systems, and rice farms near IRRI in the province of Laguna.

The format of the conference represented a departure from the usual system of formal papers and discussions. On arrival at Los Baños each participant received a set of papers on rice policy in various countries, papers related to rice technology, and reports of research on the economics of rice production, marketing, and policy. Each conference session then operated as an open forum under the direction of a discussion leader. Professor M. L. Dantwala, Director of the Department of Economics, Bombay University (India) served as the conference chairman.

Within this broader perspective, this summary attempts to give an insight into the major areas of agreement and disagreement rather than a precise record of the conference discussions.

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Rice Technology in the 1970s

Diffusion of the new rice (and wheat) technology in Asia has been extremely rapid during the last 5 years (Table 1). The initial diffusion of rice technology involved a limited number of new high yielding fertilizer-responsive varieties developed by IRRI and national research agencies. These varieties are now being succeeded by others which incorporate further advances in grain quality, resistance to pests and diseases, and adaptation to varying conditions of water control and weather (rainfall, temperature) uncertainty. Rice research in the 1970s, at IRRI and in many national programs, will place somewhat less emphasis on creating a new high yield potential. Rather somewhat greater priority will be given to realizing the yield capacity that has already been identified under a broader range of environmental and economic conditions.

Throughout the conference, a good deal of discussion related to the environmental, institutional, and economic conditions associated with performance of the new varieties relative to older varieties.

Considerable research has already been completed, particularly in the Philippines, Indonesia, and India on the performance of the "first generation" of new varieties under field conditions. Some discussants emphasized the extremely rapid diffusion of the new varieties in response to their substantial yield advantage in areas in which they are well adapted. Other discussants emphasized the limitations of the new varieties - lack of adaptation to extreme variations in water (under deep flooding, rainfed, and upland conditions), problems associated with disease and pest control, problems associated with market quality in domestic and export trade, and others.

The IRRI director, R. F. Chandler, Jr., emphasized the importance, for purposes of planning and policy, of assessing adequately the potential impact of the varieties that are currently being released or will be released over the next few years. He stressed the usefulness of feedback from micro-level studies in guiding further research. He also pointed out the danger, in a situation characterized by rapid technological change, of drawing policy implications from limited observations based on the performance of the "first generation" of new varieties.

Augustine Tan (Singapore) and others emphasized the difficulty of drawing inference for macro-economic behavior and policy from either experimental data or micro-economic observations during the initial stages of technological innovation and diffusion. This is clearly an issue to which statisticians and economists have not yet given sufficient attention. As a result, the macro-economic implications of current or potential technical change are not treated with the same level of analytical and quantitative precision as other variables for which more reliable aggregate data are generated by national statistical systems.

The net effect of the discussion of technical change in rice production and processing, both during the first day and throughout the conference, was to reject any simplistic view regarding the characteristics and potential of the new rice technology. There was general agreement, however, that if the momentum of the present research effort in Asia can be maintained, rice producers will have access to new sets of varieties and production practices adapted to a much wider spectrum of environmental and economic conditions.

An important area of policy research emphasized by a number of conference participants is the quantification of several technical constraints on growth.

Self-Sufficiency as a Policy Goal

Several governments in Asia have identified self-sufficiency as a major policy goal. The goal reflects both political and economic considerations. For most countries of the region, foreign exchange earnings represent a major constraint on the capacity to import either consumption or investment goods. Even where imports of rice, or other food grains are available on concessional terms, dependence on another country for rice may be political suicide for many government leaders. The new rice technology has, in some countries, sharply reduced the cost of achieving self-sufficiency, but has at the same time reduced the cost of imports.

There are also several seeming inconsistencies in the self-sufficiency policies being pursued. In the Philippines, self-sufficiency in rice apparently has great political significance although the growing imports of wheat cause little apparent concern. In Malaysia, the high prices designed to encourage self-sufficiency in rice production impose higher labor costs on the nation's major export commodities. In India and Indonesia and in some other countries, the goal of self-sufficiency has in the past been pursued at the regional level at the expense, in the view of some participants, of national economic integration. These apparent contradictions led some participants to view self-sufficiency primarily in a political rather than in an economic context.

Hayami (Japan) said, however, that the concern with self-sufficiency has a national, though perhaps implicit, foundation in the long term decline in the terms of trade between wheat and rice. Before World War II the prices of wheat and of rice were quite similar. By the early 1960s, the price of rice relative to the price of wheat had increased in both international and domestic markets. This sharply worsened the terms on which consumers in the rice producing countries of the tropics had access to food grains. It also weakened the competitive position of the rice producing countries of tropical Asia, in which rice is a wage good that enters directly into the cost of producing other (non-rice) agricultural products, industrial products, and other goods and services for domestic use or for export. He argued that the long run significance of the "green revolution" in rice production for Asia is that, if its momentum can be maintained, food grains may again become available to the underdeveloped countries of tropical Asia on terms that are as favorable as in the developed countries of the temperate region. The national basis of the quest for self-sufficiency becomes more apparent when it is put in the context of removing the food-production constraint on economic growth rather than when it is cast in terms of self-sufficiency at any cost.

Discussion of the self-sufficiency issue carried over into the discussion of two closely related issues - trade and diversification.

International Trade in Rice

For nearly 3 years the price of rice has been declining in international markets (Figure 1). Rice trade patterns have changed rapidly. The United States has replaced Thailand as the largest rice exporter. Japan has accumulated substantial surplus stocks. The Philippines is approximately self-sufficient in rice. Pakistan, India, and Indonesia have sharply reduced their imports. These changes lent considerable intensity to the discussion of trade policy.

The issue of whether a set of regional trade policies can be evolved that are consistent with comparative trade policies received vigorous discussion. Ruttan (U.S.) argued that agriculture is now a technology-based industry rather than a resource-based industry. Shifts in the production function are being achieved at a relatively low cost. In this dynamic environment the policy implications of traditional comparative advantage are somewhat less clear than in a world in which resource endowments represent the major source of output growth.

Sura (Thailand) pointed out that in spite of the rapid technical changes in rice production elsewhere in Southeast Asia, there can be little doubt that Thailand, where farmers have received less than $50 a metric ton during the last crop, remains a low cost producer. Noting the high prices of rice in Japan and the U.S., he claimed that the major source of distortion in price and trade relationships, at least up to 1970, has been the domestic price and trade policies in Japan and the U.S. The issue of whether Japan and the U.S. will be content to act as residual suppliers or will be major competitors in the international rice trade was regarded as a serious handicap for Asian countries as they try to plan national rice trade policies during the next decade.

Again the question was debated of whether rice trade policy is amenable to economic analysis or is subject primarily to political considerations. In spite of considerable skepticism, a view was expressed that present policies do reflect, to a considerable degree, the economic circumstances in which countries find themselves. The options available to small countries are clearly different from those available to larger countries. Thailand and Nepal are price takers in the export markets; they remain concerned with maintaining the volume of their exports in spite of adverse price movements. Malaysia and Korea continue to talk about self-sufficiency but have not yet been willing to impose the full costs of achieving self-sufficiency on their consumers. The Philippines, Indonesia, Pakistan, and India - where the proportion of the rice crop imported has now declined - indicate a major concern with stabilization policy. In the U.S. and Japan, the relatively high support prices for rice are viewed as part of the political cost of other policies which have greater national priority than efficiency in rice production. The conference reluctantly, and with considerable criticism, accepted the conclusion that neither Japan nor the U.S. is likely to bring production capacity in line with domestic consumption in the near future.

It was also generally conceded that the rice export market would remain depressed in the immediate future. There is a general tendency for wheat prices to move more in line with feed grain (corn and sorghum) prices than in the past, and it is possible that the gap between rice prices and wheat prices will continue to narrow in international markets. But in view of current rates of growth in population and per capita income, there was concern that pressure on food supplies might again emerge as a serious issue by the end of the decade.

Agricultural Diversification

The emerging potential in some Asian countries to expand rice-producing capacity more rapidly than the growth in demand raises important problems of resource adjustment at least for the immediate future. If significant growth in rice exports is unlikely, the growth dividends from higher rice productivity must be taken through some combination of lower rice prices in domestic market and a shift of resources to the production of other commodities.

It was pointed out, however, that there are serious obstacles to diversification. Much of the rice production in Asia is in the great river valleys and deltas where water control and climate preclude the production of alternative crops. It was also suggested that a shift of resources from rice to other crops implies a type of resource adjustment that rich countries, such as the U.S. and Japan, have been unwilling to make. Can we assume that resource use is less rigid in the developing than in the developed countries?

There was rather general agreement that resources could be substantially readjusted through diversification, particularly in some upland rice areas and in some highly developed irrigated areas. Most countries have already experienced some diversification though not under as intensive systems of management as in the crop diversification studies now under way at IRRI.

The pace of diversification will reflect not only the rate of growth of productivity in rice but other constraints operating on both demand and supply. On the demand side, the growth of per capita income limits the ability of the market to absorb other crop and animal products. Economic policies which distort price incentives in favor of rice (Japan) or against rice (Thailand) also have important implications for diversification. It does appear, however, that at present income levels consumers will be ready to use a large part of their higher incomes to improve the quality of their diet. If both rice and alternative crop and livestock products can be made available at lower real prices, this tendency will be reinforced by the relatively high price elasticities.

9x

On the supply side, the potential for diversification is limited by the development of improved technology for alternative crop and animal production, by lack of environmental control, and by the fact that rice in many areas is a subsistence not a commercial crop. If profitability of rice (and other food grains) continues to advance satisfactorily, some research resources should be reallocated to make the production of vegetable proteins, green vegetables and fruits, feed grains, and livestock more efficient.

In his discussion of diversification, Mosher (ADC) placed particular emphasis on the development and management of water resources to achieve greater environmental control. He argued that an appropriate development strategy would aim for neutral policies with respect to the commodity composition of agricultural output. Future investments in water control -- irrigation and drainage -- should provide potential flexibility in cropping pattern to take advantage of future shifts in demand and technological opportunities.

Modernization of Product and Input Markets

The session on modernization of processing and distribution systems focused primarily on two issues: economies of scale in processing, and the appropriate role of the public sector in marketing and distribution.

The initial discussion was characterized by considerable confusion with respect to the dichotomies - large vs. small and modern vs. traditional - as applied to the milling industry. The issue, as it finally emerged, centered on the question of the gain in milling efficiency and product quality in a large modern facility (25-30 tons/hour) as compared to either the existing (huller and sheller) small mills (2-4 tons/hour) or the modern small scale mills now in the development stage. Rawnsley (UNDP-Philippines) stated that the existing small scale mills, when properly operated and maintained, are relatively efficient. Khan (IRRI) indicated that development work now under way suggests that the efficiency of small scale drying and milling operations can be improved. Lele (India) underscored the loss in efficiency in large scale facilities resulting from higher assembly costs and deplored the social inefficiency of substituting capital-intensive milling and warehousing facilities for more labor-intensive systems in economies where labor is relatively cheap.

The view emerged, both among the economists and engineers, that there is a role for large modern drying, milling, and storage facilities to handle the export trade. But with this exception a small-scale decentralized system is likely to be more efficient both economically and socially.

It was also observed by Ruttan (USA) that the growth dividends from improvements in the product marketing system would under any circumstances be relatively small except where substantial export opportunities existed. Available evidence suggests that in most countries of the region the private sector has performed much more effectively than is frequently assumed. It was suggested that there is an important role for the public sector in the establishment and enforcement of grades and standards, in the provision of market news, and in the stabilization of producer and consumer expectations.

Discussion about the modernization of factor markets (seed, fertilizer, pesticides, credit) emphasized the relative under-development of factor markets compared with product markets. Golden (IRRI-Ceylon), in particular, emphasized the constraints on producer response to the new varieties which are imposed by the lack of development of factor markets capable of making inputs available in rural areas.

inputs X

In addition to the issues involved in the modernization of the marketing system, the issue of price supports and subsidies in factor and product markets was examined closely in several of the conference sessions. There was general agreement that in most countries, particularly those in transition from deficits to self-sufficiency or to surplus status, buffer stocks could play an important role in stabilizing prices and price expectations in producer and consumer markets. Serious reservations were expressed about the financial and administrative capacity of governments to manage stabilization schemes in which the differential between floor prices and ceiling prices is so narrow that a substantial share of total product is either acquired by or moved through public channels. Representatives of two exporting countries, Thailand and Nepal, said that their countries were so dependent on prices in external markets that any attempt to stabilize prices between "good" and "bad" years would be very expensive both financially and in terms of real resources.

X

In surplus product!

stronger!

Desai (India) indicated that he has concluded from his research, that price supports represent an effective device for speeding the rate of diffusion of new varieties and associated technology.

In a deficient products situation!

There was also considerable discussion on the effectiveness of input market subsidies vs. product market price supports in facilitating the adoption of new technology. Park (Korea) argued that it is useful to distinguish between (a) production practices that depend only on better knowledge; (b) production practices that are embodied in inputs purchased from the industrial sector; and (c) production practices that are dependent on public infrastructure development (such as irrigation development). He contended that subsidies on inputs are less expensive than price supports when the constraints on production can be overcome through the purchase of inputs from the private sector. However, if such subsidies are continued for more than a few years, their effects on the marketing system and on public administration will become costly.

Desai (India) challenged the view that fertilizer should be subsidized at all. He argued that his own studies showed that when fertilizer is introduced it flows first to the crops that are of highest value and only late to lower value crops (such as rice). He stated that for such crops, technical change leading to a steeper fertilizer response curve are much more significant than modest changes in the factor-product price ratio. There was a consensus that generalizations with respect to factor-product price ratios had not given sufficient attention to the technical response of varieties or crops to fertilization. There was general agreement that in both factor and product markets the farmer would be better served by efforts to create a viable marketing system by attempts to use factor and product markets to achieve equity objectives. Park (Korea) observed that this good advice is more difficult to follow under democratic than under more authoritarian regimes.

technology

X

11 x

Technical Changes and Income Distribution

The implications of the new rice technology for income distribution in rural areas were discussed during the second conference session and emerged as a major item of concern throughout the conference.

On the basis of the questionnaires filled out by the participants before the conference, Mubyarto (Indonesia) suggested four generalizations with respect to the income distribution effects of the new cereals technology for which he found fairly widespread acceptance:

(a) That the new technology has resulted in cheaper rice production, but that it does not necessarily mean higher real income or greater benefits to all concerned, especially the rice producers.

new technology production cheaper but growers don't necessarily benefit.

(b) That the landowner and the larger farmers receive a large share and greater benefits than the tenant or the smaller farmers, which means an increase in the disparity in income distribution.

so makes land reform more urgent,

(c) That the new technology does not alleviate but even aggravates the problem of un- and under-employment in the rural areas because it encourages more mechanization in agriculture.

new technology encourages mechanization depressing empl. opportunities

(d) That the general smallness of landholding makes it impossible to measure the farm viability by rice production alone.

There was, however, substantial disagreement with all four hypotheses. Chandler (IRRI) said that all four could be rejected for the Philippines. !! Ruttan (USA) said he would accept only the first part of hypothesis (a) regarding cheaper rice production. He criticized hypothesis (b), asserting that the new technology is neutral with respect to scale but not with respect to such institutions as land tenure, credit sources, village power structure, and others. He noted that political problems may have been increased because of the new technology as the several social classes and economic interests try to gain access to or control over the new income streams resulting from application of the new technology.

Hypothesis (c) was questioned by Rao (India) and Barker (IRRI). Rao cited Indian data for 1964-1969 showing rising employment and real wages in areas that had adopted the new technology. He foresaw an increased demand for draft power, and felt that although the structure of employment might change , the total man-hours employed would not. Barker cited the stable demand for labor in Central Luzon in spite of new technology.

On the general effect of technology on equity, Ladejinsky (IBRD-India) cited the experience with wheat in the Punjab. With new technology, land values and land rents rose. Tenants found it difficult to remain as operators and began to be displaced and converted to agricultural laborers. Even in relatively developed areas where agricultural labor has gained from the new technology, there may be increasing mechanization and consequent problems in the future. Finally, access to credit was difficult for tenants and owners without ownership certificates. However, Dantwala (India) and Desai (India) argued that attention should be placed on the absolute gain to the small farm from new technology. Rao (India) disagreed, saying that standards of equity are offended when the relative share of large farms in total income is increased even though small farms also gain in absolute terms.

Mangahas (Philippines) observed that the major income distribution problems occur within the rural sector and within the urban sector rather than between sectors. Dantwala said that with respect to the incomes of laborers, whether rural or urban, the most effective way to improve the income distribution is through a sufficiently rapid rate of productivity growth to permit the output of agricultural products to expand more rapidly than growth of demand. The effect would be a decline in the real prices of food to rural laborers in urban and rural areas. Falcon (U.S.) argued that in view of current population growth rates, large works programs are imperative in rural areas to absorb the unemployed and dampen rural-urban migration.

Perhaps the only level of agreement that was reached in this discussion centers around Mosher's (ADC) assertion that growth involves a continuous disequilibrium. Technical changes lead to new income streams that are distributed differently than earlier sources of growth. A society that achieves viable economic, social, and political development must institutionalize transfer mechanisms and redistribute the income streams in a manner that will reduce the social and political stress resulting from development.

Only area of agreement

must create institutional capability to ~~Change~~ accomodate continuous technological change!

adoption new technology = new income streams that in turn may create new social + economic stress that in turn then demands corrective action,

Implications for Research

In assessing the implications of the rice price policy conference for further research, it seems reasonable to assume that:

(a) During the 1970s, it will become feasible to shift away from a primary policy objective of simply meeting food needs to one which evaluates national investments in agricultural development in terms of contribution to national economic growth, the welfare of agricultural producers, and the generation of employment.

(b) The material and human resources available for organizing programs and projects will continue to be a major limitation in achieving agricultural development objectives, though clearly this is less serious than in the 1960s.

(c) The substitution of formal quantitative information and analysis for less formal qualitative judgments in economic policy and planning has a relatively high pay-off in achieving development objectives.

There seemed to be agreement that two areas of research deserved particularly high priority:

(1) Research designed to identify and evaluate quantitatively the technological investment and institutional constraints on growth of agricultural output. This research is essential if research resources, capital investment, and planned institutional changes are to be directed into high pay-off areas.

(2) Research related to the resolution of conflicts arising from the distribution of the new income streams resulting from technical and institutional change. The design of economic policies that are consistent with economic viability in factor and product markets and that distribute the gains of progress in a manner consistent with viable social and political development represents an important challenge to economic, social, and political innovation.

There was considerable disagreement about the skills and perspectives which economists must bring to this task. There was general agreement that the traditional pattern of academic organization of professional resources in the West, and in institutions based on Western models, wastes professional manpower. There also was disagreement about the role of the economist, as an economist, in the political process. ✓

Table 1. Estimated area planted in high-yielding varieties (HYV) of rice and wheat in West, South, and Southeast Asia.

	Rice				Wheat			
	1966/67	1967/68	1968/69	1969/70	1966/67	1967/68	1968/69	1969/70
	Thousand acres							
Turkey					1	420	1,430	1,540
Iran							25	222
Afghanistan					5	54	302	361
Nepal			105	123	16	61	133	186
West Pakistan		10	761	1,239	250	2,365	5,900	7,000
East Pakistan	1	166	382	652			20	NA
India	2,195	4,408	6,625	10,800	1,270	7,270	11,844	15,100
Ceylon			17	65				
Burma		8	412	356				
Malaysia	104	157	225	316				
Laos	1	3	5	5				
Vietnam		1	100	498				
Indonesia			488	1,850				
Philippines	204	1,733	2,500	3,346				
Total	2,505	6,486	11,620	19,250	1,542	10,170	19,654	24,409

Source: Dana G. Dalrymple, Imports and Plantings of High-Yielding Varieties of Wheat and Rice in the Less Developed Nations, Foreign Economic Development Service, U. S. Department of Agriculture, in cooperation with Agency for International Development, (Washington, D.C., Jan., 1971), pp. 35, 36.

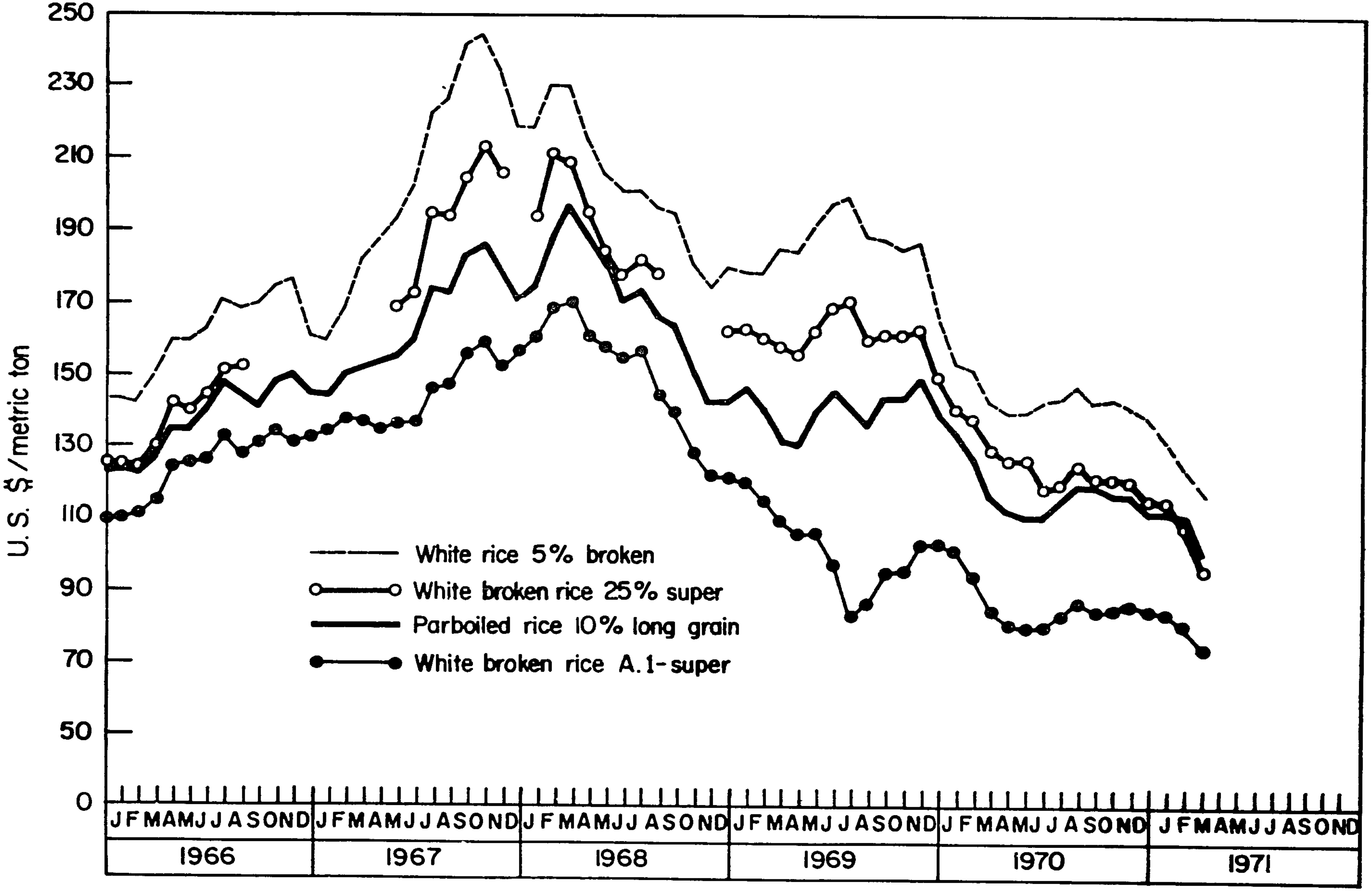

Fig. 1. The Thai export price of rice 5% broken, parboiled 10%, long grain, white broken 25% super and white broken A.1 super. F.O.B. Bangkok.

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IRRI, May 9-14, 1971

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Agricultural Development Planning and Program Evaluation with a Focus on Regional Restraints

Martin E. Abel and K. William Easter *

I. Introduction

There is now general agreement among development economists, development planners, and economic policy makers that agricultural development must be an integral part of total economic development in the poorer countries of the world. Further, there is a growing recognition that growth in agricultural output (total or per capita) is not the whole of agricultural or economic development. How such growth is distributed among regions of a country and among different classes of people, and the social costs and benefits of such growth are also important components of the development process. There are many instances of "growth without development" in the history of world agriculture, where for short periods of time agricultural output of a country increased at a rapid rate only to be choked off because either (a) the private and social cost of such growth was excessively high and resulted in inefficient use of resources which could not be sustained for a long period of time, or (b) the growth was not sufficiently widespread to create a continuously growing demand for the output of agriculture sector.[1]

It is also increasingly recognized that sustained agricultural development must be fed by a constant flow of technological innovations adapted to local ecological conditions and economically viable in terms of both private and social costs and returns [22]. Not only must there be the capacity to

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[1] For a good discussion of economic policy considerations in translating a technological innovation into a dynamic force for economic development see [30].

generate new technology, but changes must be made to improve the physical and institutional environment in which the new technology is to be used. In some cases, the new technology will create the demand for such changes. In other cases, the changes in the environment may have to be made prior to the effective use of the new technology; e.g. the requirements of new rice and wheat varieties for controlled use of water on farmers' fields. Furthermore, in some areas the improvement of the physical and institutional environment can lead to rapid increases in agricultural output even in the absence of new technology in the form of better crop varieties. These improvements in the environment will also accelerate the adoption of better varieties when they come along.[2] Thus, investment planning and bringing about a variety of institutional changes are also critical components of the agricultural development process.

A sine qua non of sustained agricultural and economic development is a comprehensive set of forward looking agricultural policies.

> "If one were asked to pick a single factor as the most common cause of a low rate of growth, it would have to be the absence of a vigorous agricultural policy. Agricultural stagnation is the main constraint on the rate of growth /of the economy/. It keeps down the living standards of the great majority of the people, and in restricting their purchasing power, restricts also the scope for industrialization.
>
> "Any agricultural policy must be comprehensive: agriculture is a complex industry both in structure and requirements. It is not possible to consider only direct 'on farm' requirements, for these soon reach out into sources of input supplies, credit facilities, price policy in relation to general inter-sectoral problems, infrastructure -- research and

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[2] See /34/. In the period 1952-53 - 1964-65, prior to the introduction of the high-yielding wheat varieties, the Punjab had an average annual rate of growth in total crop output of 5.56 percent with increased area growing at 2.06 percent annually and productivity increasing at 2.86 percent annually. Increased inputs of water, fertilizers, labor, and farm power, land development and improved management by farmers were among the more important sources of growth in crop output. These and other improvements provided the favorable production base that permitted the very rapid adoption of the new high-yielding varieties of wheat during the latter half of the 1960's.

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> extension as well as road transport and markets and major public investments such as irrigation facilities -- and, not least, needed foreign exchange resources." /12, pp. 101 and 109/.

One should be concerned not only with the "right" agricultural policies, but also with their efficiency in achieving development objectives. Here, both the content and timing of policies and programs are important. Scarce development resources should be allocated over time in ways which increase agricultural production, improve the distribution of the benefits from increased growth in output, and increase the supply of physical and human capital required for sustaining future growth in output and productivity.

In this paper we present an approach to agricultural development planning and program evaluation which provides information and analyses on a continuous basis that would (a) lead to a better integration of research, investment, and policy and administrative decision making; (b) bring into sharper focus the nature, extent and location of agricultural development problems; and (c) identify which sets of development resources are most appropriate for solving these problems.

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II. The Model

A. The Basic Approach

It is important for efficient agricultural policy and program formulation and implementation to be able to identify (a) the key factors holding back agricultural development; (b) where these forces are operating; and (c) what types and amounts of development resources and the amount of time which will be required to eliminate or ease these restraints to development. Assessing the economic and technical feasibility of eliminating these restraints is an integral part of the work.

The basic approach discussed in this paper for analyzing, planning and programming agricultural development would be a tremendous help to decision makers at the local, state and central levels of government. It should provide the base for regional and local planning with realistic expectation for the time and resources required to solve problems. This approach can be used at any existing stage of development to determine regional restraints, alternative solutions, and the time and investment required for program impacts. It would provide a firm basis for designing and operating developmental programs and research to deal with specific regional problems. In other words, it would help local, state and central officials to decide which programs are best designed for each region and focus programs on the priority problems.

The basic idea is to facilitate the identification and solution of major agricultural development restraints by dividing a country or countries into regions based on the natural, human and capital resources. Restraints to agricultural development can be thought of as those aspects of the agricultural production and marketing process that are slowing the growth in agricultural output and income, or the improvement of the distribution of income. We have grouped these restraints into eight categories: (1) water and land management, (2) provision of rural infrastructure, (3) farmer incentives and institutions, (4) agricultural research, (5) education and training, (6) provision of inputs, (7) markets and international trade, and (8) employment. Each category includes a number of restraints which will be discussed later. But they include such things as inadequate roads, shortage of electricity, inadequate supplies of credit, land fragmentation and lack of proper water control.

In delineating regions a number of variables should be considered and the weights assigned to these factors determined. Factors such as the variation in land characteristics, climate, topography, availability of water, structure of factor and product markets, education, culture, population density, and the nature of supporting institutions such as land tenure arrangements, credit institutions would be used to identify regions. In selecting factors for identifying these regions, which will be referred to as agro-climatic regions, the emphasis would be on those restraining agricultural development. Each region needs to be reasonably uniform with respect to the variation in factors affecting agricultural development but still be large enough to encompass a significant part of the country's agriculture. There will obviously be a trade-off between the size of each region and its homogeneity. Furthermore, each agro-climatic region does not have to consist of one contiguous geographic area; it can be composed of several similar yet geographically separate areas.

Once the regions are tentatively delineated through the use of existing data, the next step is to more clearly define restraints in each region through more detailed study and analysis. This would involve the analysis of alternative ways to ease or eliminate each restraint, including the time period and investment required assuming certain actions are taken. These restraints and regions may not be static, but may change as progress is made in eliminating some restraints and as research indicates that other restraints and regions are more relevant. For example, the major restraint may have initially been identified as the lack of a suitable rice variety. But, subsequently with the development of better rice varieties, better water control may become the most important restraint and different regional boundaries may be more relevant.

The concept of regionalization according to a set criteria provides a basis for isolating restraints to agricultural development at a more micro level. Alternative solutions can then be related to specific restraints within a local context rather than to some vague national or Asian problem. The regional restraints can be aggregated to provide a set of national or Asian restraints, but these restraints will be region specific. For example, the lack of drainage on heavy clay soils during the monsoon season might be a restraint in regions 2, 4 and 6 in India and regions 3 and 10 in Thailand. Thus when one deals with national or Asian problems, they are related to specific regions.

There will be some restraints, however, which are national in nature such as the level of commodity and factor prices, or the availability of certain inputs such as fertilizer. However, it is also conceivable that the intensity of these national restraints will vary among regions depending upon the intensity of agricultural production, use of inputs, and the commodity output mix.

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B. Definition of Agriculture

We define agriculture to include a broad spectrum of activities essential for sustained agricultural development. For purposes of development planning and program evaluation we would include in our definition of agriculture:[3/]

(1) The numerous activities involved in the production of food and fiber from the land;
(2) The factor markets supplying production inputs to farmers;
(3) The product markets handling the distribution of food and fiber, including imports and exports;
(4) The set of public institutions responsible for the generation and dissemination to farmers of new production technologies;
(5) The set of public institutions responsible for the formulation and implementation of agricultural policies and programs concerned with pricing of inputs to and outputs from agriculture, land tenure systems and their implementation, regulatory activities dealing with indentification and preservation of qualitative characteristics of agricultural products as well as certain production inputs;
(6) And finally, the set of public institutions responsible for public investments which have a direct impact on agricultural production such as irrigation and drainage, soil conservation, transport, power, etc. We are not concerned here necessarily with the totality of some of these other sectoral areas, such as power, or transport, but with those components which are critical to the sustained development of agriculture.

Admittedly, this is a broad definition of agriculture. But, on the other hand, a modern, progressive agriculture is a complex sector and planning its development requires the systematic integration of an extremely large number of private and public activities /29/.

The process of dealing with a complex agricultural sector can be greatly simplified if, within a framework of national policy goals and objectives for agricultural development, critical restraints can be identified, and the technical and economic feasibility of easing or eliminating

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[3/] The definition of agriculture employed here is very similar in scope to the one used by Crawford in defining the content of agricultural policy /12/.

these restraints determined. One would then analyze the benefits and costs of alternative policies and programs where the time and investments required to eliminate key restraints are explicitly treated under each alternative. Agricultural development planning can be done not only at the national level, but also in terms of agro-climatic regions or combinations of regions within which, for any given planning period, a relatively few factors may be critical in holding back agricultural development. Naturally, the mix of these factors will change with time; as some restraints are eliminated, others will come into play.

C. National Policy Goals or Objectives

Almost every nation has a set of goals which are either explicitly or implicitly stated. Some of these goals are directly developmental in nature; some are not but have indirect implications for directions and patterns of developmental efforts. Further, while many nations may share the same set of goals, the relative importance of each goal can vary widely among nations at any point in time and for any one country over time. Thus a country's long-run goals or targets should be viewed with some degree of flexibility with respect to the relative weights assigned to each goal.

In a broad sense almost every country is committed to such general objectives as improving the economic well-being of its people, improving the qualitative aspects of life such as education and health, preserving the social and cultural identity of its people, preserving (or attaining) its sovereignty within the community of nations, the defense of its people against outside aggression, and the maintenance of law and order. Increasingly countries are treating many of their goals and the process of goal attainment in an explicit and increasingly detailed manner through the process of formal development planning. Where possible goals are translated into quantifiable targets for given time periods. Attention is also focused on the instruments which a country can use in achieving these targets. And, as the process of planning becomes more detailed, recognition is given to the fact that there may be inherent conflicts among goals /8/ and that planning (and development) in some respects is a process of conflict resolution. For example, there is the inherent set of conflicts in development activities growing out of classical problems of resource allocation among sectors of the economy, within sectors, and among groups of people. Further, there may be conflicts among non-developmental goals and the developmental ones. For example, national defense considerations may dictate the allocation of resources for defense purposes at the expense of developmental activities; or, developmental expenditures may be made on low productivity projects because they have important defense implications, such as the settlement and guaranteed well-being of people in sensitive border areas. Another illustration is the maintenance of certain social groups within a country in their historic and cultural setting because society is against the destruction of their cultural values.

Some development economists argue that all or many of these goals and values can be explicitly quantified and postulated in the form of a well defined objective function which can be optimized subject to available resources and certain other constraints. While this may be theoretically possible, we know of no case where this has been done for a nation in any significant way. But this is not the important point. What is important from the point of view of this paper is that in considering the development potential of a particular area of a country such as an agro-climatic region, or the potential of the whole country, recognition is given to the developmental and non-developmental goals or targets of a country.

Thus, when we consider questions related to the level of agricultural output, the product mix, the division of production between domestic use and export, and the distribution of production, income and employment we should have a fairly clear set of national objectives in mind. Similarly, when it comes to evaluating the questions of efficiency and productivity of investments in both the private and social sense, a variety of parameters like interest rates, social and private discount rates, factor and product prices -- nominal, real and shadow prices -- will have to be explicitly dealt with /16, 26/.

While this paper focuses on the development of a systematic framework for evaluating agricultural development and identifying key areas of needed research, education, and investment, we assume that this is done within a framework of national goals and objectives. Neither time nor space permit more detailed discussion of these broader questions. But for the purposes at hand, this is not necessary as long as the reader recognizes the important inter-relationships between our interest in the agro-climatic region approach to evaluating present and future agricultural development activities and the broader issues of growth, development, and non-economic goals and objectives.

What is of direct relevance, however, is the formulation of policies and programs which are the means by which national goals and objectives are obtained and for which information and analyses are required. An identification and analysis of critical restraints to agricultural development on the basis of agro-climatic regions can provide the informational and analytical inputs for efficient and effective policies and programs.[4/] The analyses and basic information about each agro-climatic region would be made available to policy makers and program administrators. Within a given political and administrative structure, key decision makers could use the new information to achieve a more efficient allocation of development resources. These decision makers are subject to a variety of political and social forces at both national and regional levels. In a practical sense, these people are the ones who must decide on the relative importance assigned among economic, social and political considerations nationally as well as among regions. Short of the development of a comprehensive objective or social welfare function, providing key decision maker with better information and analyses along the lines discussed above should lead to a better allocation of developmental resources. This would come about as a result of more sharply defining problems (restraints) and alternative solutions which, in turn, would lead to the selection of investment possibilities with higher social returns both within and among agro-climatic regions.

[4/] For an excellent discussion of the role of policies and programs see /11/.

III. Taiwan: An Example

One of the most advanced models of agricultural development planning in Asia based on agro-climatic regions is to be found in Taiwan. A brief description of this experience[5] provides a useful illustration of how our proposed model can be used to considerable advantage.

As far back as 1950, seven agricultural regions were systematically defined in Taiwan /10/. These have been expanded to 13 agricultural regions as Taiwan's agriculture has become more complex, illustrating the importance of allowing for changes in the boundaries of agro-climatic region over time as a result of changes in restraints. These regions were defined on the basis of the following information: topography, climate, soils, stage of land settlement, cropping patterns (acreage, yield and production of different crops and intensity of cropping), forestry, density and characteristics of the population, size distribution of farms, tenancy characteristics, livestock numbers, irrigation, electric power, and transport.

The agricultural research structure in Taiwan conforms in large measure to the needs of each agricultural region. At the apex of the agricultural research structure is the Taiwan Agricultural Research Institute in Taipei, under the Provincial Department of Agriculture and Forestry. Related to this central research institution are a set of 10 Agricultural Improvement Stations; one for livestock, one for vegetables, one for horticultural crops, and one each for the (original 7) agricultural regions. The location and research program for each Agricultural Improvement Station were, in large measure, determined after the agricultural regions of Taiwan were first defined.

The Agricultural Improvement Stations are concerned with the adaptation of basic research results coming from the Taiwan Agricultural Research Institute to the conditions within each agricultural region. And, the research subjects at the Taiwan Agricultural Research Institute are based on problems that are identified in the agricultural regions. The typical organizational structure for the Agricultural Improvement Stations includes programs in crop production, livestock production, seed multiplication, and farm management. Furthermore, within each agricultural

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[5] We are indebted to Dr. T. H. Lee, Mr. C. H. Luh, and Mr. C. T. Cheng of the Joint Commission on Rural Reconstruction for the information presented here on Taiwan's Agricultural Development Planning.

Basic level?

region there are farmers associations in each township. The Agricultural Improvement Associations work closely with the Farmers Associations in adapting and extending new agricultural practices.

There are also 24 Irrigation Associations in Taiwan. While their programs and administrative structure are independent of the Agricultural Improvement Stations, there is close coordination between the two sets of institutions on matters concerned with the complex of water use and crop production.

For certain new crops, research is done by the Taiwan Agricultural Research Institute and the extensions of results to the farmers is done through marketing cooperatives and the Farmers Associations.

At the national level, the National Planning Committee, the Joint Commission on Rural Reconstruction, and the Department of Agriculture and Forestry have responsibility for national agricultural policies and planning. Full use is made of the agricultural regions and the decentralized research and extension structure to determining public resource allocations and agricultural development priorities in different parts of Taiwan. Two examples of current efforts in Taiwan illustrate how this "system" works.[6]

The Joint Commission on Rural Reconstruction is preparing a set of long-term demand projections for both domestic and foreign demands for agricultural products. At the same time, studies are being conducted within each agricultural region on the production potentials for different agricultural commodities. It is intended that these two sets of studies will provide a basis for making allocations of agricultural development resources by Government to each of the agricultural regions. As an illustration, in the future development of livestock production, investment preference is being given to the drier, non-irrigated areas in order to maintain balanced growth in output and incomes among regions.

Agri - Demand/Prod. Study here!

Another example, is a current study of farm mechanization. In recent years, the real wage rate in agriculture has been growing rapidly as a result of rapid growth in non-farm employment. In the absence of suitable farm mechanization, the rapidly rising cost of labor in the farm sector would lead to a decline in agricultural production. In response to this situation, the Joint Commission on Rural Reconstruction has initiated a three year study of mechanization in both irrigated and non-irrigated areas of Taiwan to determine the best forms of mechanization (planting, weeding, transplanting, harvesting, threshing, storage, etc.). The economics of collective use of different types of machines is also being studied. The studies are being carried out on the basis of agricultural regions by the Agricultural Improvement Association in cooperation with the Farmers Associations

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[6] The authors are grateful to Dr. T. H. Lee, Joint Commission on Rural Reconstruction, for descriptions of these two research efforts.

IV. Application to India[7]

India is an illustration of the advantages of dividing a large country into agro-climatic regions. This is particularly critical in India due to the wide variations in soils, climate, topography, cropping patterns, availability of water, population density, etc. as one moves from north to south and from east to west. There are five broad geographic divisions in the country; the coastal areas, the Himalayan mountains, the Gangetic plains, the central plateau and hills, and the western dry area. Within each of these major divisions there are anywhere from four to ten distinct agro-climatic regions. For example, the Gangetic plain is divided into eight regions ranging from the northern wheat region, which includes most of the Punjab, to the Bengal paddy-jute region, which includes most of West Bengal. Each region is made up of eight to twelve districts that are fairly uniform with respect to the variation in climate, water availability, land characteristics and culture. In total, thirty one agro-climatic regions have tentatively been identified.

A. Development Goals, Policies and Programs

The major goals for Indian agriculture involve meeting the nation's food and fiber needs, achieving more rapid growth in agricultural production, income, and employment, and a better distribution of income.[8] To achieve these goals, policies and programs should be promoted which ensure an adequate supply of food and fiber and an equitable distribution of gains among those who have worked for the development of agriculture -- farmers of all sizes, tenants and landless laborers. Under certain conditions programs to develop agriculture and improve the distribution of gains will have to be operated separately. For example, it may be more efficient to promote agriculture development in selected areas or among certain groups of farmers while using rural works projects, taxation and land reform to deal with problems of income distribution.

One of the key problems in analyzing the process of modernizing agriculture is measuring progress towards the twin goals of economic development and an equitable distribution of income. Another aspect is measuring the trade-off between the two goals since certain policies and programs may promote a better distribution of income but have an adverse effect on agricultural production. For example, radical land reform that creates a large number of uneconomic size units may be justified on equity grounds but may have an adverse effect on growth in agricultural production (reducing the marketed surplus and savings).

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[7] This section draws heavily upon /14/.

[8] See for example /2,18,27/.

How progress is measured will also depend on the program or restraints which are being considered. Overall performance can be indicated with data on production, yields, acreage, etc., but identification and elimination of restraints will require more sophisticated data and analysis. The analyses will have to be structured to fit the restraint or program. To illustrate, the unit of measurement for studying tube well development in Ludhiana district of the Punjab would be the farm operating unit since the decision concerning the well is made by the farm family except when electricity or some other key input is limited. In contrast, a study of the water management problems in the canal irrigated areas of Sambalpur or Raipur would require analyzing the village or sets of villages since the decisions concerning water use and management require group decisions. Field to field irrigation involves many externalities, for what one farmer does will affect others. Improvements in irrigation and drainage are achieved, in most cases, only by village action or by action of larger political divisions such as a district or state depending upon the size of the problem. Thus the relevant unit for analysis of these irrigation systems is a village, a group of villages or a larger, political unit, rather than just the individual farm. In each case, the programs required will be quite different. In Punjab the programs might involve increased availability of credit and electric power as well as a better understanding of ground water supplies and their optimum use in the long-run. In Raipur or Sambalpur the focus might be on improving the efficiency of water use in farmers fields and the development of canal water management associations responsible for the management of irrigation water for a part or all of the irrigation system, involving numerous villages.

It is useful to distinguish between two types of policies and their differential impact on the goals of improving growth and distribution. The first level can be characterized as those policies and programs which generate profitable new technology for farmers. This involves a producer oriented price policy along with new high yielding varieties of seed and the inputs (fertilizers, chemicals, etc.) required to achieve high yields. With just this level of assistance a number of farmers will make great progress and as has happened in some of the wheat areas of India, the country will begin to make substantial increases in agricultural production. Generally, the first level of policy will benefit those farmers who have already begun the process of modernization or those who have the resource capability to begin to do so. However, total progress may begin to slow down or even stop without the second level of policy which is concerned with involving more farmers and areas in the growth in farm income and production. Furthermore, without this second set of policies, growth in production and income will tend to concentrate the gains among the more progressive farmers.

Precisely the key areas of our Rsh. Dev. Project!

The second level of policies and programs are concerned with areas or groups of people that have not participated in the advances in agriculture development. The problems and restraints holding back different sections of the country or groups of farmers or laborers become the important issue once a country's agricultural modernization or development has commenced. It may be possible to improve the lot of some through farming; for others off-farm employment will have to be created through the construction of rural infrastructure, the expansion of services related to factor and product markets, and finally the growth in other sectors of the economy.

The program or policies necessary to deal with these restraints require detailed knowledge and understanding of a region's rural people and agriculture. In contrast, the first level of policies, particularly price policy, tend to have similar impacts throughout the country and require less knowledge of the regional differences in agriculture. They also can be administered fairly effectively by the central government. This is much less true of the second level of policies. The restraints that are now preventing modernization of certain parts of Indian agriculture are quite varied. What accelerates development in Raipur district of Eastern Madhya Pradesh may not have any impact or a distinctly different impact in Surat district of Gujarat or the Tungabhadra area in Mysore and Andhra Pradesh.

B. Identifying Agro-Climatic Regions 9/

At this stage of development in India the second level of policies are becoming more important although producer oriented pricing policies and new technology will continue to play a key role in modernizing Indian agriculture. But with this growing list of problems which are restraining agricultural development in various parts of India, a system for considering these differences becomes increasingly critical. Such a system should start with identifying regions based on the factors affecting agricultural development. However, the emphasis needs to be on factors restraining agricultural

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9/ In the development of this section we have benefitted from earlier studies /13, 31, 36, 37, 38/.

development although other factors will also be important in defining a region. For example, soil and climatic characteristics are important in defining agro-climatic regions, but they are not necessarily restraints. In other words, restraints are just an important subset of the factors used in defining regions.

The factors used to identify regions can be grouped under three headings; natural, capital and human resource factors. Natural resources include those factors that are naturally present in a country and are difficult to alter such as climate, soil, topography and surface and ground-water availability. Rainfall, days of sunlight, cropping patterns, temperature, irrigated acreage by type of facility and soil type are some of the variables that should be tried in identifying regions on the basis of natural resource factors. The human resource factors are those characteristics of a population that indicate its productivity such as education, certain cultural factors, training, health, motivation, and institutions. Land ownership patterns, population density, proportion of landless labor, and years of schooling are variables that should be tested for identifying regions by human resource factors. Capital resources involve those factors that can be altered or made available through the efforts of labor and capital such as roads, market facilities, processing facilities and credit availability. Miles of roads and numbers and amount of loans in rural areas would be indicators of capital resources.

The exact variables finally used and the weights given to each in identifying regions would be the end results of analysis where a number of models are tested each with different sets of variables and weights. The testing would involve comparisons at any point in time as well as the amount of variation over time. Regions will not be uniform with respect to all of the above factors but will have some variability. The important thing is to have these intra-regional variations defined and accounted for in the analysis. Also, it is not necessary for the regions to be contiguous or that the total country is included in the regional division.

Another important aspect of these regions is that they must be flexible and subject to change and aggregation. Research and program action which more clearly defines restraints and results in progress towards the elimination of certain restraints may alter regional delineation. Also in analysis and program planning for certain restraints it may make sense to aggregate selected regions or parts of regions. The flexibility in the use of regions must be built in from the start.

a top-down
approach that makes
sense from natl capital
But each level of govt -
i.e. the provinces in Phil.
will in turn consider the
[illegible] geographic-[illegible] for sample
to existing
planning areas.

The district and region will also provide the basis for aggregation to the national level. The framework has the property of additivity over regions, since one can determine the geographic extent of each restraint, i. e. within one region, several regions or nation-wide. For certain problems it will make sense to consider a set of regions. For example, the sorghum growing regions should be considered as a group when dealing with the shootfly problem and so should the wheat regions in the case of the rust problem.

Some will always argue that district aggregations are too gross since there are wide variations in water availability, land quality and farming within an individual district. But by delineating regions with a similar variation in characteristics and selecting a district as representative of that region, one can still focus on the variations in conditions within a district. After analysis of the district these results can be extended to the appropriate sections of the region. Such an approach allows analysis and program planning to be concentrated on approximately 30 districts rather than diffusing the effort over India's 328 districts.

When agro-climatic regions cross state boundaries political considerations may affect certain restraints. Still the fact that parts of states have similar climate and agriculture will mean they have common problems. The main differences are more likely to be in the means used to attack the problems. Thus the transfer of experiences between states will be facilitated by identifying agro-climatic regions and allowing them to cut across state boundaries where appropriate.

The following is a tentative classification of India into five divisions, fourteen zones and thirty-one regions. Modifications will be made as further analysis more clearly identifies restraints and regions. The divisions are based primarily on broad geologic and topographic differences while the zones are based more on soil and climatic differences. The regional classification is concerned with variations in farming (cropping patterns) and the availability and quality of agricultural and human resources.

I. Himalayan Division

A. Western Himalayan zone (Jammu and Kashmir, Himachal Pradesh and Northwestern U. P.)
   1. Northwest Paddy-Maize-Wheat region.
   2. Northern Wheat-Paddy-Maize region.

B. Eastern Himalayan zone (Assam)
   1. Assam valley paddy-jute-tea region.
   2. Eastern hills paddy region.

II. Gangetic Plains Division

A. Upper Plains zone (Punjab and Haryana)
   1. Northwest wheat region.
   2. Northwest wheat-gram-bajra region.

B. West Central Plains zone (Western U. P.)
   1. Southwestern U. P. wheat-pulse region.
   2. Northwestern U. P. wheat-sugarcane region.

C. East Central Plains zone (Eastern U. P. and Bihar)
   1. Bihar paddy region.
   2. East central U. P. paddy-wheat region.
   3. U. P. - Bihar paddy-sugarcane region.

D. Lower Plains zone (West Bengal)
   1. Bengal paddy-jute region.

III. Plateau and Hills Division

A. Central Plateau and Hills zone (Eastern Rajasthan, and Northwestern Madhya Pradesh).
   1. Northcentral wheat-pulse-jowar region.
   2. Central wheat region.
   3. Northcentral maize-wheat region.

B. Eastern Hills and Tribal zone (Inland Orissa, Southern Bihar and Eastern Madhya Pradesh).
   1. Eastern inland paddy region.
   2. Inland paddy region.
   3. Central wheat-paddy region.

C. Western Deccan Black Soils zone (Southwestern Madhya Pradesh and Inland Maharashtra)
   1. Central cotton-jowar plateau region.
   2. West central jowar-bajra hills regions.

D. Southern Red Yellow Soils zone (Inland Mysore, Andhra Pradesh and Tamil Nadu).
   1. West central jowar-cotton region.
   2. East central jowar-groundnut region.
   3. Southern mixed farming region.

IV. Coastal Division

A. West Coast Plains and Ghats zone (Kerala, Mysore and Maharashtra).

1. Kerala paddy-fruit-spice region.
2. West central coastal paddy region.

B. East Coast Plains and Hills zone (Orissa, Andhra Pradesh and Tamil Nadu)

1. Northeastern coastal paddy region.
2. Southeastern coastal paddy region.

V. Western Plains and Hills Division (Western Rajasthan and Gujarat)

A. Southern Gujarat zone.

1. Western groundnut region.
2. Western cotton region.

B. Western Dry zone.

1. Western bajra-pulse-livestock region.
2. Western bajra-wheat region.

C. Processes for Identification and Evaluation of Restraints

Identifying and developing solutions for regional restraints will be a lengthy process that will vary with the region and the restraints. A multi-disciplinary team could be set up to do this in each region. The work in each region would involve the time of a number of agricultural specialists from different fields such as plant pathology, entomology, agronomy, agricultural economics, soil science and water engineering, as well as several key government officials. The composition and organization of the team would depend on the particular region selected and the restraints involved. Key Indian institutions that could be included are the Ministry of Agriculture, State and District Governments, and research institutions such as the Indian Council for Agricultural Research, the Indian Agricultural Research Institute, and the Agricultural Universities.

The team would deal with an area's agricultural development in three stages. First, it would review and analyze the region's restraints and prospects for development. In this stage gaps between programs and restraints would be identified. Second, the team would suggest alternative plans and programs to promote the region's agricultural development. Here an important question would be how to organize from the

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state down to the district level to provide technical assistance and coordinate development efforts for dealing with a region's restraints. Third, there would be a review of progress over time along with a feed-back of information to those involved in the programming and planning for the region and India.

One important aspect of identifying restraints is the time-frame (1, 5, 10 or 20 years) required for their possible elimination. In other words, does modernizing agriculture in the socially and agriculturally backward areas of West Godavari district in coastal Andhra Pradesh require the development of a whole new cropping system complete with new varieties, which may take 10 years to develop, or does it require an assured supply of water which can be provided by wells in several years? Also something needs to be indicated about the length of time required to start work on the problem. For cases such as new seed varieties the work may already be underway while in others, such as tube-well development, additional problems (lack of credit or information about ground water resources) may delay implementation. One also needs to have an idea of the likely time path toward solution of the problem. It may take 20 years to improve an area's water system but can 75 percent of the system be improved in the first 5 or 10 years? Further, what would be the best sequence of events? Should work begin on improving the road system now or should it wait until the region's water system is improved? Such an approach would provide a better basis for judging when to start long-term investments; it may help to avoid delays in starting on long-term investments because quick-pay off investments look more attractive.

Regional analysis using district data from a particular region can be used to estimate the significance of different independent variables on agricultural production. Both time series and cross sectional data should be tried and several different equations fitted. Irrigation, weather, fertilizer use and new seed varieties are just a few of the dependent variables that should be tested.

Linear Programming

Programming or simulation models could be developed for selected areas to test the importance of different resource and technological restraints. At present adequate data is not available to develop such models. Thus one of the first steps in constructing area programming models will be the collection of input-output data. One key element is an estimate of the likely impact of new technology on input-output coefficients over the next decade.

Resource budgeting and mapping can be used to indicate regions of high development potential or ones which would be limited by the lack of resources. A systematic budgeting or inventory of resources, infrastructure and available technology would also help identify the important development problems in a region.

Comparative analysis using resource budgeting or other techniques will be one of the most effective ways of identifying restraints. Areas or groups of farmers that have already increased production and adopted new technology should be analyzed and compared with ones that have not. The basic idea is to look at the extremes rather than the averages which tend to hide too many problems and answers. Comparative analysis should help indicate the probable impact of eliminating various restraints and identify factors that promoted agricultural development. For example, what has been the impact of hybrid bajra in Gujarat or of the improved village irrigation systems in Sambalpur District and can these experiences be expected elsewhere?

Ideally for comparative analysis areas should be selected that have significantly different growth rates and distribution of agricultural production. These comparisons can be within a district or between districts or groups of districts. One comparison might be between an area which has had resource development and another which has not. A second comparison could be between an area which has adopted a new technology and another which hasn't. Finally, an area that has experienced both new technology and resource development should be compared with other areas. This latter comparison would indicate the importance of the interaction and complementarity between new technology and resource development.

One effective procedure of acquiring data for the suggested models and providing a basis for comparative analysis would be to develop some representative farms for each important agro-climatic region. These farms could be used to estimate or approximate what impact certain restraints have on agricultural production and the distribution of gains. The representative farm could also be used for cross comparison between regions. The data for each representative farm could be compiled synthetically from farm records or surveys. Another procedure would be to select actual representative farms for continuous analysis. Farm records and/or surveys would be kept on each farm. The sample of farms needs to be flexible so that it can be altered if it is no longer representative of the farms in an area.

D. Restraints to Agriculture Development

On a national basis a long list of restraints can be identified but within a given agro-climatic region it is hypothesized that two or four key restraints are limiting at any point in time. Eliminating these key restraints, if feasible, is the important issue for each region's development. The identification of restraints is viewed as a continuous process with new problems arising and old ones being solved or found not of primary significance.

The restraints identified by regions will provide the basis for research and analysis of Indian agriculture. Programs and policies should be analyzed in relation to their impact on the various restraints. If a region is plagued by limited water supply then progress would be measured in terms of ability to conserve and develop water supplies, and to develop crops, cropping patterns and cropping practices suited to limited water availability. As mentioned above an important aspect of defining restraints is the time required to remove them. Progress in eliminating any single restraint will provide incremental benefits, but in the process other restraints may become increasingly binding.

The restraints will be discussed briefly under eight categories each of which includes a number of restraints. These headings include water and land development, rural infrastructure, farmer incentives and institutions, agricultural research, education and training, provision of inputs, markets and international trade, and employment. The following discussion presents a partial listing of key restraints under each of the above categories.

1. Water and Land Development

Water and land development, defined to include drainage, salinity control, land shaping, irrigation, flood control, and soil and water conservation, will continue to be one of the major problems facing Indian agriculture into the 21st century. Yet certain aspects of these restraints can be dealt with, at least, partially during the next ten years. Possibly the best opportunity for making more dependable supplies of water available, besides groundwater development, is through reducing water losses in existing irrigation delivery systems and improving water management.

There are two levels where water and land development should be implemented. First is the village and farm level where the following problems occur: (a) soil erosion and sedimentation of canals, reservoirs and other water works, (b) inability of individual operator to control or depend on his water supply unless it is his own tube-well, (c) lack of people trained in the basic elements of soil and water management, (d) water seepage and evaporation losses from tanks and canals with little or no information concerning quantities lost and alternative means for reducing losses (cost), (e) lack of maintenance on irrigation and drainage facilities, (f) systems of pricing and schedules for delivering water that encourage inefficient water use practices from a village, state or national point of view, (g) land fragmentation and uncertain land tenure and (h) lack of institutional arrangements to organize irrigation and drainage systems at the village level.

The second level is the State and National level. The Ministry of Irrigation and Power must become attuned to agricultural needs and requirements. It must become Centre and State Government policy to move in the direction of intensive irrigation. Command areas must be reduced so that farmers who purchase water can be assured of an adequate water supply, at least during certain years, and the new high-yielding varieties can be successfully grown. State planning of water projects needs to be improved particularly in terms of greater flexibility in project design and impact on employment, both during and after construction. Better systems have to be developed for supplying water to the farmers when and where the water is required for efficient crop production.

The techniques for dealing with these problems are already available, or could be developed in a few years. About half of India's some 90 million acres of "irrigated" land is under canal irrigation not suited to controlled or scheduled delivery of water. The main hope for the existing systems is that over time they can be selectively modernized. For future systems, it can be hoped that the engineering designs will encompass the flexibility to make "modern" approaches possible. But political and bureaucratic problems could delay significant improvement both in existing systems and the design of future systems for well over a decade.

Further, there needs to be a better assessment of the quality and quantity of ground water resources and better planning for the conjunctive use of surface and ground water. Additional information about groundwater supplies are needed to reduce the uncertainty involved in drilling or digging wells. This is a national problem that will not be solved by the year 2000 even if an accelerated hydrologic survey program is started today. Related to this is the need for a much wider coverage of detailed soil-surveys that can be reliably interpreted and used in classifying land. Such surveys would take several decades to make and interpret.

But tax maps [illegible] productivity already exist!!

With respect to the problem of drainage and associated salinity on both irrigated and non-irrigated lands, which affects millions of acres, there is yet to evolve adequate policy, professional competence, and institutional arrangements, as well as massive financing to comprehensively tackle the job. The opportunities for increasing production through drainage are great, but the job will take decades to complete.

In areas without adequate groundwater or surface water supplies, research is needed to develop cropping patterns and practices which will allow farmers to obtain the most from the limited water and land resources. This will require new drought resistant varieties as well as just a better use of existing varieties. Some of the research in this area should bear fruit in a few years while others concerned with new varieties will take longer.

Finally the lack of water user's organizations to construct, operate and maintain systems for irrigation, drainage, erosion control and flood abatement is one of the overriding restraints. No country has made adequate progress in controlling and managing its agricultural water without such institutional arrangements. Further, water user's organizations could be one key to solving land fragmentation problems. Since land fragmentation is one important restraint to efficient irrigation and drainage systems, a good water user's organization would have to solve this problem. Yet the Government of India isn't fully aware of the importance of water user's organization for India's agricultural development let alone knowing how to deal with the problem. Therefore, even if work were started today this restraint would not be eliminated in the 20th century.

2. Rural Infrastructure

The second set of restraints includes the lack of adequate rural infrastructure (communications, transportation, electric power, education, water, health services, training and marketing facilities) and the related problems and opportunities. The benefits from supplying these facilities accrue over a long period and to many people, and are vital for continued economic development. Some of the facilities can be provided through rural works projects which can also afford needed employment opportunities. The completed facilities can then support the growth in agricultural production which will be necessary to meet the growing demands for food and fiber.

The provision of rural markets for products and inputs is an important element of rural infrastructure. Special consideration should be given to input markets which are much less developed than product markets. As more inputs and products move through markets, transportation and storage problems will become more critical. More information is needed indicating where market surpluses will be located and where they can be sold. Also in what areas are inadequate roads or markets lowering product prices received by farmers (particularly the small farmers) and limiting production response and growth in farm income?

Providing the rural infrastructure will require several decades of intensive work some done by the private sector and some by the public sector. Research is needed to indicate how best rural works can contribute to the development of rural infrastructure and in what areas and in what sequence the infrastructure will be needed. Projects should be analyzed to ascertain capital requirements and the number and type of labor which might be employed, while surveys need to be initiated which estimate the type of labor available in different parts of India and to determine its mobility. Research should be designed to help determine what kinds of infrastructure are most critical in terms of economic development and rural employment and in what areas they can best be provided by rural works projects. In other words, which areas are not developing due to the lack of infrastructure and have a rural labor force available to build the facilities. This work should be started in the near future so that it can be used as a guide for the Government of India's rural works program.

3. Farmer Incentives and Institutions

The third group involves restraints which affect farmer incentives and the institutions supporting agricultural development. These restraints include product and factor prices, taxes, subsidies, lack of land reform unstable tenure conditions, fragmented land holdings and inadequate credit institutions.

With respect to product prices, both their level and stability are important factors in determining the production response of farmers. In regard to factor prices, policies and program should be followed which keeps these prices in line with relative factor endowments on the one hand, and encourages an efficient lowering of the prices of those factors which lead directly or indirectly to greater use of the factors in most abundant supply, i. e. labor. An example would be taking advantage of technological improvements and economies of scale in the manufacture of fertilizer /35/ which leads to greater use of fertilizer per acre, higher yields, and larger labor requirements provided appropriate pricing policies are followed with respect to mechanization.

The slow progress in land reform, stabilizing tenure arrangements and land consolidation is likely to continue in the next decade unless there is some major shift in the rural power structure. Although there are some economic forces related to tube-well development and mechanization that increase the incentives for land consolidation, these same forces may encourage landowners to displace tenants because of the increased returns from farming.

Taxation and its impacts on incentives is another problem that needs analysis. To illustrate, the export taxes on tea and jute have helped reduce India's export market for these crops. Short run gains in tax revenues may be more than offset by the longer run losses in foreign exchange. In contrast, there is virtually no tax on agricultural income and very little on land. Taxes on both might have much less adverse effects on incentives to increase production than taxes on crops as well as having a beneficial effect on income distribution. A general review is needed of India's agriculture related tax policies which could take several years. But once this review is made it may be several years before substantial improvements can be expected or proper enforcement initiated.

A related problem is subsidies for certain agricultural inputs such as tractors. A key question is why subsidize big tractors and farm machinery? Such policies definitely have an adverse effect on the distribution of income and the commitment of national resources. Agricultural subsidies, both direct and indirect, should be reviewed in conjunction with agricultural taxes and prices to provide an overall and more consistent agricultural policy. This policy should give due consideration to the impact of taxes, product and factor prices, and subsidies, on income distribution, agricultural production and export earnings. Furthermore, these policies must be consistent with India's resource endowments including an abundant labor supply.

Finally, the total availability of credit resources and its availability to different groups represents a serious constraint to agricultural development in many areas /2/. Particularly important is the set of institutional biases which discriminate against the small farmer, the insecure tenant, the share-cropper, or certain socially disadvantaged groups, in favor of the medium or large sized land owners. Both equity and production issues are involved. Continued favoring of the already advantaged groups would further accentuate disparities in incomes. Also, the production potential of the land owned or farmed by those who are not favored represents a large source of potential growth in future income and employment for the nation. It is important that this latter group be provided with financial resources and technical information to make them more productive.

4. Agricultural Research

Under agricultural research, one of the basic restraints will be the continued requirement for ~~new crop varieties~~. New varieties of wheat are needed which afford greater genetic diversity. Disease and insect resistant rice varieties are required which fit the local tastes and climatic conditions, particularly for the wet season crop. In dry areas more drought resistance hybrid varieties of jowar and bajra should be developed to provide greater stability in crop production as well as to increase yields. Also, attention will have to be given to insect and disease problems of these crops. Technological breakthroughs in agricultural production will have to continue if the process of modernizing agriculture is to accelerate during the 1970's and spread to all parts of India, particularly the dry areas where new crops, cropping patterns and practices to increase earnings are lacking. Progress may be quite slow in certain areas. For example, it will probably be several years before ideal varieties for rice and even longer before improved crop varieties for dry areas can be developed.

Closely related to research to develop new technology is the research to adapt the technology to local conditions. This is the step of taking new technology and determining its suitability to various areas or regions. Important aspects of this include the work in multiple cropping, the development of a package of practices and selecting alternative farm enterprise. Research has to be done at the district level to determine what are the alternatives best suited for the given resource, economic and sociological conditions. Such research may indicate the need for new varieties which are suited for particular farming conditions.

On the other hand, it may indicate how the present package of practices should be altered or how multiple cropping might be practiced under certain conditions. This type of research will be needed in many areas. However, the time required to do the research will vary widely between areas. In fact, adaptive research should be a continuous type of work concerned with adapting new technology and solving local agricultural problems.

5. Education and Training

The problem of educating and training people with the skills which will be demanded is a perpetual problem. For example, there are still too many civil engineers while there is a shortage of people trained in water use and management techniques and in the area of farm power and machinery. The need for education and training in water use and management exists for millions of Indian cultivators, as well as for the thousands of professional and sub-professional workers. Until cultivators have available to them organized technical services, they cannot be trained and assisted to solve their community and individual problems. Only now is there the beginning of an effort to educate and train people in water management (the soil-water-plant complex). This task will take a few decades. A similarly long training and education task will be necessary in farm mechanics as mechanization expands. Tractors, threshers and other farm machinery will need to be kept running and will have to be developed and adopted for Indian conditions of small holdings and a large labor supply.

Another aspect of this problem is the need to hire people who are technically trained to do a job. This will be a more critical problem as agriculture grows in complexity. Furthermore, State and District administrators concerned with agriculture will need to have a better technical understanding of agriculture if government programs are to be more effective.

Extension education and training will have to be restructured to do a better job of reaching farmers with relevant kinds of information. This will require the upgrading of the Village Level Worker's (VLW's) through training and hiring methods as well as the use of innovative approaches such as the Stage II village program.[10] More training of existing VLW's by

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[10] The Stage II village program is a special IADP program. It was used only where villagers after, learning about it, agreed to work together and use technical guidance and increased inputs. Local leaders stimulated action and IADP provided technical help. The results in Raipur district have been very encouraging. In particular, all the farmers in the villages, large and small alike, benefited from the program /39/.

State and University specialists will be a minimum requirement. This in-service training should be organized to reach the extension worker every year. These problems of vocational and extension education and training are long-term problems and will not be solved quickly. Special attention will have to be given to reaching the small farmer.

6. Provision of Inputs

This group of restraints includes problems related to providing credit, fertilizer, pesticides, machinery and improved seeds. Although significant progress has been achieved in providing the inputs necessary for increasing agricultural production, the system of supplying inputs is still very imperfect. Improved training and use of pest control devices is a must during the 1970's. An effective survey and surveillance program to monitor diseases, insects and other pests would allow control measures to be applied more effectively than the present prophylactic approach. More needs to be known about the impact of various types of farm mechanization on crop intensity and employment before a policy is settled on for the next decade. Means have to be found to make adequate amounts of credit available to the agricultural sector to meet the requirements of more intensive production. Seeds of the new varieties of crops must be multiplied and made available to all classes of farmers as soon as possible, but not before they have been tested and adapted to local conditions. Marketing facilities and storage will have to improve if these inputs are to reach the farmer when he needs them and in good condition.

Seasonality of demand for inputs, particularly when there is multiple cropping and, therefore, overlapping seasons, complicates the problem of ensuring that the supplies are available on time, in the right place and of good quality. Decentralization of input distribution will help since local suppliers will better understand local conditions. A centrally operated program has much greater difficulty adjusting to the widely different seasons and cropping patterns that exist in India.

The private sector is now being relied on more heavily to provide farmers with key inputs such as pesticides, fertilizer and credit. This trend should continue and will help solve some of the input problems during the 1970's. With less Government action required to supply inputs in the future, State and district officials should have more time to work on other important agricultural development problems.

7. Markets and International Trade

The other categories of restraints have been primarily concerned with the supply side of agricultural development. This category is concerned with the demand restraints which may be holding back agricultural development. We can consider three levels of demand -- international, national, and regional. Furthermore, as development takes place the rates of growth of demand will vary among different agricultural commodities.[11] These variations will call for shifting patterns of resource use and changes in the relative emphasis given to increasing productivity for different commodities. For example, the relatively slow growth in world demand for jute and jute products represents a restraint to expanding production in India and may require some shift in resource use away from jute to other crops, notably rice.

At the national level, the relatively poor consumer acceptability of the early improved wheat and rice varieties led to significant price discounting in the market. This acted to reduce the profitability of the new varieties and was one of the many factors restraining production. This restraint has been clearly recognized and scientists have developed varieties with improved grain "quality" and acceptability. Another situation is represented by the lack of adequate processing facilities given that the production of a particular commodity looks promising. Soybean in India is a case in point. There is ample domestic demand for soybean oil and domestic and world demand for the meal. Further, there are now a number of soybean varieties which have been adapted to local conditions and yield well. Within the next 5 years it is reasonable to expect sufficient soybean processing capacity to begin to significantly ease this restraint and create a larger effective demand.

Finally, one can identify a number of situations in which the level of local or regional demand for agriculture products has acted as a restraint to increasing production. This is particularly relevant for perishable products like fruits, vegetables, and milk. In such cases, much can be done through the development of infrastructure -- rapid transport, proper storage, and processing to expand the geographic boundaries of the market.

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[11] This category of change can also include the effects of technological developments which lead to a substitution of synthetic products for agriculturally produced products; e.g. the substitution of synthetic fibers for commodities like cotton, wool, and jute.

8. Employment

A discussion of restraints to agricultural development in India would not be complete without emphasizing the need to generate considerably more employment in rural areas. Improving the distribution of employment and income is a major national concern. And, while it is a national problem, the needs for improvement are clearly more critical in some areas than in others.

There are at least two major reasons for concern about employment, or the lack of it -- poverty. First, for humanitarian as well as political reasons, society is increasingly unwilling to tolerate large and even growing incidences of extreme poverty. Secondly, large numbers of people suffering from under- or unemployment and low incomes act as a drag on economic growth. On the one hand, their low, stagnant, and sometimes declining levels of real income do not provide the demand pull necessary for expanding national output. On the other hand, their under- or unemployment represents a waste of an important resource which could be used to create capital and increase productivity and production.

Within the context of agro-climatic regions one could look at four levels of expanded employment opportunities. First, to what extent can employment be increased by increasing agricultural output in a region? This will vary among regions depending on their agricultural production potential and how fast this potential can be realized. It will also depend on the extent to which policies and programs for agricultural development are pursued which generally emphasize the use of labor relative to capital. Second. to what extent can employment opportunities be generated in factor and product markets associated with increased agricultural production and modernization. Third, at some stage the development of rural infrastructure, as discussed above, becomes critical to rapid and sustained growth in agricultural output. Numerous investments will be required, many of which can be labor intensive in their execution. Considerable employment opportunities can be generated in many rural areas through sizeable rural-works programs aimed at generating productive capital. The selection, timing, and "choice of techniques" need to be carefully analysed so that employment opportunities are not needlessly lost /2/. Finally, there will be areas of the country where the above three approaches to increasing employment will not be sufficient to solve the problems of poverty. In these situations, the following should be considered:

th = 4 alternative

(a) generation of employment in non-agriculturally related pursuits within the region; (b) migration to areas with better employment opportunities; or (c) if both of these are not enough or possible, a system of income transfer could be implemented to provide the very poor with a minimum level of income as defined by society.

E. Restraints by Agro-Climatic Regions -- Some Examples

The three regions considered below are those which include an innovative IADP district and are just an example of how restraints can be identified with a given time horizon. These five districts are included in three distinctly different agro-climatic regions. Restraints are identified on a preliminary basis in each of the five districts which are fairly representative of the three regions. The next step will be to develop the data and analysis necessary to test the regional importance of each restraint for a given time frame.

1. Southeastern Coastal Paddy Region

This region includes the east coast districts of Andhra Pradesh and Tamil Nadu from East Godavari to Tirunelveli, eleven districts in all. It is a region of very high resource potentials and high land productivity, particularly in rice. From East Godavari south the coastal plain is much wider and the plateau areas included within it are smaller than the districts to the north. Monsoon comes to Tamil Nadu during October and January while the Godavari area is in the transition zone between Tamil Nadu and the June to September monsoons of the north. In fact. due to the differences in development and monsoons the region may need to be subdivided when considering certain types of problems. For example, Ramanathapuram and Tirunelveli districts in Tamil Nadu may fit better with inland districts such as Madurai since they have distinctly lower and less certain rainfall and are more backward than the rest of the southeastern coastal districts. In contrast Godavari, Krishna and Cauvery deltas are the most productive and prosperous areas although they are quite densely populated with a high proportion of scheduled caste laborers. The Godavari river runs through both East and West Godavari districts, the Krishna river affects both Krishna and Guntur districts while the Cauvery river primarily irrigates Thanjavur.

West Godavari district of Andhra Pradesh and Thanjavur district of Tamil Nadu provide examples of districts with high resource potential at either end of this rice growing region. In Thanjavur three restraints to further modernization of agriculture are of key importance. First, new high yielding varieties need to be propagated that are suited to the Samba and Thaladi crop seasons. This is something that is already being worked on and could be successful in the next five years. The second restraint is the unstable tenure situation that could get worse as the population grows and the profitability of farming increases. Unstable tenure particularly on temple lands slows the adoption of improved practices. The third restraint and the one requiring the greatest investment will be to provide an improved and more timely water supply. Without a more assured and controlled water supply large increases in the intensity of crop product will be impossible. Two sub-restraints which are holding up improvement of the water supply are (1) land fragmentation without any means of fostering land consolidation along with a village structure not strong enough to provide the necessary pressure and compensation to allow the installation of an improved village irrigation system, and (2) a district irrigation system that doesn't provide adequate drainage or irrigation during critical periods. The World Bank is considering a ten year program to improve the districts irrigation and drainage system but the land fragmentation problem promises to get worse over the next decade.

In West Godavari two restraints stand out as limiting agriculture development. First, is the need for a better system of adapting new crops, combinations of crops, and practices to the various conditions within the district. The new adaptive research team in the district is one step towards developing such a system. If the university team approach proves successful then an effective adaptive research system may be operative in the next five years. The second restraint is similar to one found in Thanjavur district. It is the need to develop and improve the districts water supply. This will include well development, flood control and drainage. There are other problems facing these districts but many of them are subsets of the above restraints. For example, in West Godavari, the need for a groundwater survey to guide further well development is part of the second restraint. So far the only active program for improving the district's water supply is a tube-well development program. A broader based program is needed that considers all aspects of the district's water problem from flood control to water conservation. Some of the problems such as the provision of better drainage outlets into the Bay of Bengal will require State or Central government action and probably cannot be completed before the 1980's. Other problems including inefficient village irrigation systems and improper field drainage can be dealt with through district programs with results starting to accrue in the 1970's.

2. Inland Paddy Region

Included in this region are twelve districts ranging from Dhenkonal and Baudh-Khandmals in Orissa to Balaghat district in Madhya Pradesh. Also included in this region are Chanda and Bhandara districts of Maharashtra. The districts are fairly uniform in resource potential with the exception of Basta in Madhya Pradesh and Koraput in Orissa which have much lower resource potentials and should probably be considered separately for certain development programs. The region has fairly heavy monsoon rainfall (between 1,200 and 1,700 mm), although it is undependable. Rice has been by far the most important crop but yields are low and variable particularly in the non-irrigated areas. Much of the region is hilly with large acreages under forests and a large population of lower caste people. Thus one of the important developmental problems is to promote economic growth that benefits the low caste people.

Raipur and Sambalpur are fairly representative of the districts with the higher resource potential. For the irrigated areas of these two districts the lack of multiple cropping alternatives, and faulty water use and management are two key restraints. In the rainfed areas new crop alternatives and water conserving farming practices need to be fitted to the particular climate conditions. Thus one basic overriding restraint is the lack of research to develop new techniques and varieties that can substantially increase farm income and production. Work has already started on the other key restraint, faulty village water systems, in both Raipur and Sambalpur. This will be a long term program which will require a continued involvement of district staff over the next several decades. In regard to research, a long hard road remains ahead if effective research institutions are to be established. It will probably be twenty years or longer before these institutions are well established and begin to produce significant new technology which will increase farm income and production.

3. Northwest Wheat Region

There are thirteen districts in this region including all the districts in the Punjab plus Ambala and Karnal in Haryana. Irrigation is extensively developed and is one of the key inputs for increasing and stabilizing agricultural production. The region has had a marked increase in irrigation in recent years due to the growth in tube-wells. On the other hand, certain areas are plagued by water-logging. Wheat, maize, gram, cotton, rice, groundnut and sugarcane are important crops grown in this region.

High literacy, lower pressure of population on land, progressive agriculture and small scale industry are all characteristics of this region. These conditions are reflected in a low percentage of agricultural laborers, high wage rates and high per capita incomes relative to other agro-climatic regions of India.

Ludhiana is representative of the central part of this region although it has been more progressive and has more irrigated acreage than the average district. Approximately 70 percent of the cropland in Ludhiana is irrigated. The major crops are wheat, groundnut, maize, cotton and sugarcane which occupy 43, 17, 15, 3 and 2 percent, respectively, of the combined cropland for kharif and rabi. Relatively speaking the restraints to agricultural development are much less significant in Ludhiana than they are in most other parts of India. On the other hand, the distribution of gains from agricultural development requires special consideration particularly with the rapid advances in wheat production that have occurred in the latter half of the 1960's.

One of the key problems relating to agriculture development and the distribution of gains is the supply and demand for different qualities of labor. Mechanization is progressing rapidly in Ludhiana and could cause fairly sharp changes in the labor picture. Mechanized threshing of wheat and shelling of corn is now widespread. As mechanization continues what will be the changes in demand for labor and where will the shortages or conversely the surpluses of certain skills act as a restraint to agricultural development or to an improved distribution of income?

Electricity to operate the wells and threshers and keep much of the small industry running will likely become a more important restraint during the 1970's. The uncertainty of electricity will also lead to inefficiencies in water use as the farmer will try to irrigate whenever electricity is available, rather than when the crop requires moisture. The same type of problem will arise with attempts to thresh before the crop is too dry.

Finally greater genetic diversity in wheat varieties will be required during the 1970's due to the rising probability of disease problems. Too high a proportion of the wheat is planted to one high yielding variety while other high yielding varieties are related in one way or another. Thus one race of stem rust could just about wipe out the district's wheat crop. Genetic diversity is being developed through the All-India Coordinated Wheat Improvement Program and results should accrue during the early 1970's.

V. International Considerations

In this section we discuss some selected developmental situations and problem areas which might have international significance for agricultural development, and which are amenable to the agro-climatic region approach.

One of the appealing characteristics of the agro-climatic region approach to agricultural development planning is that it could provide a better basis for comparing similar problems in two or more countries and facilitate a greater sharing of research and development planning experiences. Instead of trying to compare nation-wide experiences, one would focus on a comparison of agricultural development in similar agro-climatic regions which exist among several countries. It is much more likely that the natural resource characteristics of agro-climatic regions in several countries will be much more similar than the human and capital characteristics. But this is not bad. If one can "standardize" on the basis of natural resource characteristics, one would have a better basis for studying the influence of variation in the non-physical factors on agricultural development. Or, conversely, interest might be focused on areas with similar factor[12] endowments, but which differ with respect to natural resource conditions.

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[12] In a comparative study of agricultural development in Thailand and the Philippines with particular focus on rice, Ishikawa states:

> "In considering the strategies for generating a dynamic force for a developing agriculture on the supply side of production, it is advisable to take into consideration substantially different water conditions among regions or countries. ... I have stressed the major difference in the water conditions between Central Luzon and the Central Plain which results in the difference between an agriculture which is operated on the basis of flood control and an agriculture which adapts itself to flooding over a wide rice-producing area. While this difference is described with regard to [the Philippines and Thailand], it seems to exist between other regions in Asia. Essentially what we need now is a separate formulation of the strategies which will provide, for the countries or regions whose agriculture adapts itself to flooding, a more concrete policy guideline. Research along these lines seems important. It may in fact require studies to classify the regions and countries into a few broad patterns according to the major differences in natural conditions"[24, pp. 125-126]. See also the study by Hsieh and Ruttan [23] and [15, p. 24].

There is a growing recognition of the importance of and reliance upon the international transmission of new agricultural technologies. This is illustrated by the growing importance of international agricultural research centers in the development of improved crop varieties. However, these centers cannot substitute for national research programs. As the technological base in agriculture grows, there is a tendency for new crop varieties to become increasingly location specific. In a study of technical change in three commodities -- sugar cane, bananas, and rice -- Evenson, Houck and Ruttan /17/ suggest that there are four stages in the technological development processes associated with plant varieties. Stage I is concerned with the selection of natural (wild) varieties; i.e. finding those wild varieties which are the best producers. This stage tends to be very location specific. Wild varieties have survived through a process of natural selection; they are the varieties proven to be most adapted to local soil, climatic, and disease conditions. This stage of technical development does not generally lend itself to the geographic transfer of varieties because of different ecological conditions in other areas. Stage II in the plant development process consists of crossing natural varieties from different areas and selecting those new ones which exhibit the highest degree of adaptability. This stage constitutes a widening of geographic adaptability. However, it also represents a highly random approach to development of new varieties with widely acceptable characteristics such as disease resistance. Stage III is characterized by breeding for specific plant characteristic and as such represents a move away from a random to a systematic approach. Finally, Stage IV is characterized by plant breeding programs designed to develop plants adapted to specific soil and climatic conditions. This represents a further degree of location specificity over Stage III.[13] The delineation of agro-climatic regions would help identify specific locational conditions to which new plant varieties have to be adapted and, as such, provide valuable information to plant breeders.

Within regions of the world where certain crops loom large in the agricultural economics of many countries, such as rice in Asia, a delineation of agro-climatic regions in several countries could provide a basis of comparing research and development experiences on the basis of regions which are essentially similar with respect to soils, climate, water resources, insects, and diseases. Such comparisons could speed the development of new technologies and their international transmission. The same would apply to investments to improve the production environment such as more controlled use of water in farmer's fields, the development of factor and product markets, and the role of institutions supporting agricultural production and development.14/ 15/

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[13] For an excellent discussion of the need for decentralized research to effectively adapt crops to different types-of-farming regions see /28/.

Certain restraints tend to be location specific while others relate to several regions or to the whole nation. Some experiences will be transferable from one region to only a few other regions due to the natural factors, while other experiences may have much wider application.

Work done in a number of Asian countries other than that referred to for Taiwan and India represent a start on delineating agro-climatic regions. In Thailand, Rajanasoonthon and Moorman /32/ have delineated six physiographic regions which represent a more detailed subdivision of the four standard regions used heretofore. Further refinement has been added by Fukui and Takahashi who have identified 12 distinct rice producing regions within the Central Plain of Thailand /19/.

Welsch has recently argued that "formulating technically sound agricultural policies and programs in Thailand would be greatly facilitated if there were a careful delineation of the type-of-farming areas or resource base areas or agro-climatic zones or whatever you wish to call them -- the concept is the same for each term. The Land Development Department has made a start in defining the 6 'physiographic regions'. For agricultural programs a slightly finer delineation is needed into perhaps 15 or 20 areas in the Kingdom. For example, one cannot tailor a program for the Central Plains /since the area varies/ from cattle grazing areas near the Burma border, through the heart of the delta with its deep water floating rice, to the central highland corn growing areas of Takli and Chaibadan. A similar situation exists in the Northeast.

14/ "The Survey Team was impressed with the similarity of the problems in each country; even the diversity that gave uniqueness to each country's concerns had a familiar ring as one moved from one nation to the next." /6, p. 51/.

15/ In a study of both developed and less developed countries, Hayami and Ruttan /21/ have demonstrated the economic advantage of favorable natural resource endowments, particularly land. While their approach is not directly relevant to the use of agro-climatic regions as a basis for identifying restraints to agricultural development, it might be worthwhile thinking about how the approach, suitably modified, could be used to evaluate the economic growth potential of different regions within a country as well as among similar regions located in several countries.

"Once the basic resource availability in each area is known, then the constraints in each region can be determined. In some, it will be a supply constraint, which calls for one type of program. In still other areas, the resource base may not be sufficiently productive to be amenable to agricultural improvement, and will call for basically social welfare policy decisions. The choice may be among stimulating industry to move in to provide employment, encouraging people to move out to places where there is employment, or making income transfers."/41/.

In East Pakistan twenty physiographic regions and fifty-seven sub-regions have been identified on the basis of physical features and drainage/33/. Seven climatic sub-regions have also been delineated /33/. Furthermore, East Pakistan has been divided into 122 agricultural regions based on cropping patterns. These regions vary in size from half of a thana to ten or more thanas. Drainage pattern, soils, total rainfall, pressure of population on the cultivated land, nearness of urban centres and many other factors contribute to the factors which determine the land use and crop pattern of each of these regions /33/. However, it is highly unlikely that each of the 122 agricultural regions would represent a separate agro-climatic region; rather, each agro-climatic region would be an aggregate of several of the agricultural regions. Already, a number of key restraints to increasing rice production in different areas of East Pakistan have been identified which could be analyzed within the framework of the agro-climatic regions approach.16/

16/ These restraints are as follows:

1. Water Problems:

a) As of 1967, only about half a million acres of paddy land had controlled irrigation for the "boro" and early "aus" seasons. It is estimated that an additional 4 million acres adjacent to rivers could be irrigated with low-lift pumps. In addition, potential exists for expanding the area irrigated by tubewells.

b) Solving the problem of over-flooding of paddy fields in the Aman season is more difficult and more costly than providing dry season irrigation. It involves the cleaning of drains, the building of river bunds, and a greater knowledge of the flooding experience on specific fields so that farmers can plant improved varieties of rice on fields with shallow flooding. Taller IRRI varieties of rice may also provide some adaptation to the flood problem.

c) Salinity and flooding problems in the coastal areas, and drainage problems in these and certain other represent another set of restraints.

d) Flooding in the deep-water, rice producing areas represents still another restraint. It is doubtful that it would be economically feasible to bring adequate water control to these areas. This restraint may be overriding, and attention will have to be given to developing improved deep-water varieties of paddy.

(cont'd. on next page)

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Looking at rice producing areas such as East Pakistan and the Central Plain of Thailand as well as similar regions in other countries /24/ one could define sub-areas with similar production conditions and comparative studies of agricultural development and key restraints would be of considerable value. One such area of study from both biological and economic standpoints would be for the deep water or floating rice areas. There is already a considerable flow of biological information among countries under the auspices of the IRRI program. These could be supplemented with economic analyses. Similarly, the production of rice during the dry season in delta areas where there exists a potential for low-lift irrigation from rivers or tube-well irrigation could represent another important area of study. Here one would be concerned not only with the performance of different varieties, but also with the economics or irrigation -- the use of water in farmers' fields, the investment requirements in developing irrigation facilities, and the secondary investments required to support expanded irrigation such as fuel or electric power requirements, capital requirements for pumps and tube wells, foreign exchange requirements for both direct and indirect capital imports, and the transport, storage, marketing and price implications of expanded rice production /42/.

Another example of agro-climatic regions that cut across country boundaries is found in the wheat areas of Northwestern India and Pakistan. "The /Punjab of India/ is actually a part of a larger ... geographically homogenous region that stretches from West Pakistan ... and extends into the other Indian states like the newly formed State of Haryana, Western

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f.n. 16 contd....

2. The control of insect and disease problems is another major restraint to increasing rice yields and production, particularly during the wet season.
3. Staff capacity for an integrated and sustained rice research program is also a key restraint which would be operative for all the rice producing regions in East Pakistan.
4. Marketing and milling facilities can be identified as a significant restraint which will worsen in those areas where production begins to increase rapidly. One should be able to anticipate the timing and magnitude of this restraint within each region on the basis of factors related to expanding productions /3, 4, 5/.

Uttar Pradesh and Northern parts of Rajasthan. With only a few minor changes, ... data on field crop operations are relevant to this entire geographic region."[40]. Further, restraints such as wheat diseases and pests, water-logging, and soil salinity are quite similar for this whole region. Thus the transfer of experiences within this region should speed the solution of restraints.

Opportunity for use of Taiwanese in Philippines!

For many of the countries of Asia improved use of water resources on farmers' fields -- irrigation, drainage, or the better use of rainfall represents a key restraint to improving agricultural output and broadening the base for agricultural development. While much has been written on the importance of improving water resource use, much less has been said about the social and institutional changes which are implied by the improvement of water use at the farm level [7]. In the last analysis it is the farmers themselves, individually or collectively, which make irrigation systems work well. For example, the engineering and management involved in Taiwan's irrigation systems are impressive. But equally impressive is the institutional bases -- social, legal and organizational -- upon which these systems are predicated and which make them operative [43]. And, throughout much of South and Southeast Asia the institutional basis for improved use of water resources is lacking. Different social, cultural, and political situations in Asia offer the opportunities to test different hypotheses about the practicability of alternative approaches to water management in basically similar agro-climatic regions. Also, it would be of interest to study how water management principles and organizational requirements vary among different types of water supply conditions. For example, one could ask to what extent the differences between the type of water supply, soils, etc. in Taiwan and a flooded rice area like the Central Plains of Thailand require different organizational structures for the management of irrigation.

Another set of restraints which have international as well as domestic implications relate to the size and rate of growth of markets for agricultural products. These restraints are important for determining the market potential for individual commodities as well as the commodity mix which may be most appropriate for the quantitative and qualitative resource endowment for each country.

With respect to export demands, the combined effects of increased production in both exporting and importing countries on international trade and world prices of a commodity can act as a restraint on increasing production in exporting countries. In particular. sharp changes in exportable supplies can cause significant price variation in world markets. The sharp decline in world rice prices during the past few years from abnormally high levels is a case in point. However, price movements in and of themselves should not be overexaggerated as a serious, long-run restraint. This is so for several reasons. First, if the increase in production comes through improvements in technology and gains in production efficiency, the real cost of the commodity is lowered. Such cost reductions benefit the domestic economies of the exporting country (and possibly the importing countries as well). Second, for new entrants in the export field, non-price factors such as the lack of marketing and storage facilities, processing facilities, transportation facilities, and quality control measures may be a much more important set of restraints than the lower price.17/

The same reasoning holds true for domestic markets.

In some cases, there may not be a lack of demand for agricultural products or modern agricultural inputs; rather the problem may be insufficient marketing and processing facilities to enable farmers or suppliers of inputs to take advantage of existing demands. Usually after successful production technologies have been developed, restraints in product or factor markets may develop -- marketing, storage, processing facilities, and availability of key inputs. One example of marketing and processing restraints is the case of soybeans in India discussed earlier. Another example is the unavailability of electric power or diesel oil to power tubewells in certain parts of India. The lack of electricity in some areas results from either a shortage of power or a lack of transmission lines to the villages. In the case of diesel fuel, there does not exist a set of market facilities to get it to interior villages, particularly those which are some distance from an all-weather road.

a questionable statement - fuel? in costs of [illegible] villages, [illegible] - but it is true! True

Possibly more important than the price movements in both world and domestic markets for individual commodities is the ability to create a higher degree of substitutability of factors of production among different agricultural commodities so that the price mechanism can become a more efficient allocator of resources/1/. The ability to shift resources among the production of different agricultural commodities will vary among agro-climatic regions. It is important to analyse the restraints operating in different agro-climatic regions which limit resource mobility among agricultural crops. Some of these restraints may be physical in nature and it may or may not be economically feasible to remove them. In the case of deep water rice, the cost of controlling water in farmers fields would be prohibitive and there is, therefore, no known alternative to continuing to produce rice. Efforts should be made to develop

[illegible] fish ponds!

17/ See for example /20/.

higher-yielding varieties suitable to such areas. On the other hand, in many of the irrigated rice areas of Asia, achieving controlled use of water on individual fields would not only improve the production environment for rice, but also enable a diversification of agricultural production. Many investments of this type would prove to be highly profitable in terms of both private and social net returns.

Other restraints to both diversification and intensification of agricultural production may be technological in nature. The development of adapted new varieties to a particular region and the development of new sets of agronomic and cultural practices may be required to permit diversification and increased intensity of production. This will be particularly true for many rainfed areas without irrigation potential where one of the primary objectives is to make more efficient use of the existing water supply (primarily rainfall) which is usually unevenly distributed throughout the year. There are at least three major considerations in increasing productivity per acre in rainfed areas. First, productivity can be increased through improving the yields of crops presently grown. Second, the introduction of adapted new crop varieties and the adjustment of cropping patterns can lead to an increase in net value of output per acre. Finally, through measures which conserve soil moisture and which shorten the growing season of crops produced during the rainy period, sufficient soil moisture may be available to produce a second (or third) crop, thereby increasing the intensity of cropping. Viewed in this way, positive directions could be given to work in soil and water management, plant breeding, and agronomy.

x. optimizes returns from limited capital (requires minimum capital investments)

Associated with increased productivity per acre as a result of increasing yields, changing cropping patterns, and increasing the intensity of crop production is an increased demand for mechanical power or mechanization. Also, mechanization of Asian agriculture with its typically high man-land ratios represents an extremely important set of policy issues related to the levels and distribution of employment and incomes /9, 25/. One would want to distinguish between those forms of mechanization which augment the supply of land and increase the demand for labor, and those which lead to a substitution of machines for labor. Policies to encourage mechanization of the former type should be encouraged while mechanization of the latter type should be discouraged. However, formulating appropriate policies will not be easy since the same type of mechanization could be land augmenting and increase the demand for labor in one region with a particular type of farming and, at the same time, be labor displacing in another region with a quite different cropping pattern. For example, in a region where only one crop is

Crucial in shortrun

possible or where two crops can be grown but with considerable time between the harvest of one and the planting of the other, the use of tractors for plowing and seed-bed preparation could be purely labor displacing. On the other hand, in areas where several crops each year are possible and where there is a time constraint between the harvest of one and the planting of the other, mechanization of plowing and seed-bed preparation could be both land augmenting and increase the demand for labor. The mechanization might displace labor in the plowing and seed-bed preparation, but the added employment generated by growing the additional crop(s) might more than offset this displacement.

The study of the relation of different types of mechanization to labor use is important among agro-climatic regions within a country. But valuable information can also be gained by studying the experience in similar agro-climatic regions (similar cropping patterns) among several countries at different stages of development in farm mechanization. Several possible examples come to mind. First, there are similar trends in farm mechanization in the Punjab, in West Pakistan, and the Punjab and Western Uttar Pradesh in India. Second, there is the experience of mechanization in irrigated rice areas such as parts of Central Luzon in the Philippines, parts of the Central Plain of Thailand, and part of India such as the irrigated areas in the Southeastern coastal paddy region. Finally, a comparison of experience between the corn producing areas in Thailand and certain rainfed areas in India might also be worth intensive study.

VI. Conclusions

We have presented a proposed framework for agricultural policy and program planning based on the concept of agro-climatic regions and the identification of key restraints to agricultural development in each region as well as some which are national in nature. We believe that this approach is efficient with respect to the amount of information required to achieve a better alignment between the use of various developmental resources and the problems on which these resources can have a significant developmental impact. This approach initially focuses on the better use of existing information; new information should be subsequently developed to fill important data gaps highlighted by the analyses conducted under this approach. A further advantage of the proposed framework is the inherent coordination required among policy formulation, program design and implementation, investment planning, and the development and propagation of new agricultural technologies.

We also feel that the agro-climatic regions and restraints approach would facilitate the exchange of agricultural development experience among countries. And, it could also provide a basis for providing sharper focus to international research efforts and a better perspective as to the relative importance of different types of problems both within and among countries.

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Rice and Economic Growth: Japan's Rice Policy in Historical Perspective

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Japan's rice policy in the past decade represents a major violation to the theory of international comparative advantage. Continuous hikes of government support resulted in the price of rice to the domestic producers more than double of the import prices in the late 1960's.

Such high level of support implies a heavy burden on the national budget. In the budget for 1971 the government expenditure for the rice support including the deficit of the Food Control Special Account and the expenses for the for the retirement and diversion of paddy fields, amounted to 463 billion yen (1.3 billion U.S. dollars), which accounts for 50 percent of the budget for agriculture and forestry, nearly 5 per cent of the total national budget. At the same time the price support on rice impeded the shift of agricultural resources from the production of rice to the other products of rising demand such as livestock products and vegetables. It also discouraged the outmigration of farm labor to non-agriculture when labor shortage became a permanent feature of the economy.

It is the purpose of this study to analyze this current policy issue in the historical perspective of the modern economic growth of Japan since the Meiji Restoration (1868).[1] It may appear that the problem is of a recent origin, but the current issue of rice control and price support can best be understood in terms of long-term changes in the role of rice as a critical wage good in response to changes in industrial structure and per capita income. The interaction of rice policy and economic growth in the history of Japan would also provide relevant information on the strategy of economic development to countries in South and Southeast Asia, which are now exploring the design of converting the production potential of rice and other food cereals, increased by the recent technical breakthrough, into overall economic growth.

I. Rice and Economic Growth: A Hypothesis

Industrialization and economic growth are conditioned by the availability of agricultural surpluses, especially the surplus of basic food staples as wage goods for industrial workers ("surplus" defined here as the difference between production and consumption by producers). In the classical model of economic development from Ricardo to Arthur Lewis (19) and Fei and Ranis (2), returns to capital (hence, capital formation and economic growth) critically depend on the elastic supply of labor to industry, which, in turn, depends on the elastic supply of food to urban sector.[2]

Food may be imported from abroad, but it implies the drain of foreign exchange needed for the import of capital goods and technical know-how, critical for development process.

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Within less than a century, Japan has emerged from being a predominantly rural state to becoming one of the highly industrialized nations in the world (Table 1). In the course of the industrialization rice has been the critical wage good. Figure 1 shows that rice had been the source of more than 60 per cent of total calorie intake of the Japanese before World War II, and it was only in the late 1960's when the share of rice in the total calorie intake declined below 40 per cent.[3] The share of rice in the consumption expenditure of urban blue-color workers continued to be as high as 30 per cent until 1930. In spite of rapid growth in per capita income the share of rice in the consumption expenditure of urban worker households did not decline below 10 per cent before 1960 (Table 2).

For the industrial development of Japan before 1960, particularly before 1920, in which labor intensive light industries such as textiles predominated, especially in the manufacturing of export goods, it was critical to supply cheap rice to industrial workers in order to keep their living costs and wages low.

When Japan opened the door to foreign countries shortly before the Meiji Restoration, Japan was under the real danger of colonialization by the western powers. The national slogan was, then, to "build wealthy nation and strong army" (Fukoku Kyohei). In order to attain this goal it was considered necessary to "develop industries and promote enterprises" (Shokusun Kogyo).

Assuming the industrial development as a national goal, we would expect that the policy was designed to secure the supply of rice, which could prevent the rise in the cost of livings of urban workers. Figure 2 plots the price of rice since 1880. The current (undeflated) price shows a clear upward trend with big jumps during the two World Wars (real line). A remarkable fact is that the price of rice deflated by the general price index (dotted line) remained at about a same level from the early Meiji period up to 1960, though it was subject to considerable fluctuations due to business cycles(among which most pronounced are downswings in the mid-1880's due to so-called "Matsukata Deflation"[4] and in the early 1930's due to the World Depression, and an upswing by the boom of World War I).

In terms of the long-term trend in the deflated price of rice, it is clear that the rapid rise in rice prices during the 1960's is an entirely new phenomenon in the modern history of Japan. The terms of trade of rice with other commodities clearly diverted from a boundary which had stayed stable from 1880 to 1960.

From the observations in Figures 1 and 2, and in Tables 1 and 2, we would postulate the following hypotheses concerning the interactions between rice policy and economic growth in Japan:

First, from the beginning of the Meiji Period to 1960, institutions and policies were, intentionally or unintentionally, so designed as to prevent the price of rice relative to the general price index from moving outside of a stable boundary. The prevention of a rise in rice prices above a certain upper boundary was motivated to facilitate the industrial development by keeping the cost of the critical wage good below a tolerable level in the economy in which labor intensive industries predominated. Policy to keep rice prices above a lower boundary was naturally motivated to prevent the living of majority of population from declining below a subsistence level for avoiding social disorders. More positively it was intended to preserve the basis of reproduction of agriculture, and to keep alive the incentive of farmers to increase rice production and productivity. Decline in the production of rice, and hence, in the rice self-sufficiency, had to be avoided, because it implied a drain on foreign exchange critical for industrial development.

Second, by the unprecedented spurt of industrial development since the late 1950's the industrial structure of Japan has been transformed and urban wages have risen dramatically. Strength of Japanese industry in international competition has no more rested on "cheap labor". In response to rise in wages and income, the share of rice in urban workers' consumption expenditure declined. Importance of rice as a wage good, once critical for industrial development, has been drastically reduced. The Japanese economy has reached to a stage in which a rise in rice prices can be tolerated.

Continuous hikes of rice prices during the 1960's was the result of extremely strong political pressure of farmers, requesting for the parity of their income and level of livings with those of urban workers. It is, however, inconceivable that the political pressure of farm organizations could have brought about a rise in rice prices in such scale as to divert domestic prices several times above international prices if rice would have remained as a critical wage good as was before World War II or even before 1960.

II Rice Policy for Industrial Development

In the previous section it was hypothesized that until World War II agricultural institutions and policies were so designed as to facilitate industrial development by securing the supply of rice to industrial workers sufficient to keep their cost of living from rising, without causing a drain on foreign exchange. In this section we will review the history of agricultural policies in Japan before World War II from this angle.

Institutions for Delivering Marketable Surplus

The policy which contributed most to increase in the marketable surplus of rice in the early Meiji period should have been the Land Tax Revision (1873-76)[5]. The revision was aimed at securing the stable government revenue by changing from the feudal tax in kind levied in proportion to quantities harvested into a modern land tax in cash based on the fixed value of land. With this revision farmers and landlords were compelled to sell nearly one quarter of rice produced in market in order to pay the new land tax.

The Land Tax Revision had another important consequence; it accelerated the concentration of the title of land in the hand of landlords. Because the new land tax was fixed in cash, small farmers often became difficult to pay the tax in the years of bad harvest or low rice prices. They were compelled to borrow money from wealthier farmers or landlords, and many of them lost their title through foreclosure. This process was greatly accelerated during the Matsukata Deflation in the mid-1880's, which resulted in a drastic decline in rice prices (see Figure 2). The area owned by landlords rose from less than 30 per cent of total arable land area at the survey for the Land Tax Revision to 40 per cent in 1892, and it continued to rise to nearly 50 per cent by 1930 (Ouchi:26, p.67).

In those days rent for paddy fields was paid in kind (roughly 50 per cent of harvest). The accumulation of land titles by landlords implied the increase in the share of rice output to landlords who had much lower marginal propensity to consume rice, contributing to the increase in marketable rice surplus. Rice export in the early Meiji period was supported by the squeeze on the income of farmers by heavy land tax and rent[6].

The more positive measure to increase rice supply was to increase the productivity and output of rice. Shortly after the Meiji Restoration government tried to develop Japanese agriculture by importing western farm machineries, crops and livestocks with western (Anglo-American) farming techniques. This policy of direct "technology borrowing" proved unsuccessful because of differences in both climatic and economic conditions. During the 1880's government quickly shifted to a strategy of agricultural development with the emphasis of raising yields of traditional food staples, above all, rice[7].

For this goal it was attempted to develop a labor-intensive and land-saving technology by screening and tailoring Japan's indigenous techniques by modern agricultural sciences from Germany (soil science and agricultural chemistry of Liebig tradition). Establishments of the Itinerant Instructor System (1885) and of the Experiment Station for Staple Cereals (1886), which grew to a national system of agricultural experiment stations, were along the line of this strategy. Also, the government encouraged farmer organizations for agricultural improvements such as Nodankai (Society for discussing farming matters) and Shushi Kokankai (Society for exchanging seeds) as media for improving and propagating better techniques.

As the result of such efforts rice production gradually increased, but it failed to keep up with increase in demand during the initial spurt of industrialization from the recovery of the Matsukata Deflation to the Sino-Japanese War (1894-95). Japan turned from a net exporter of rice to a secular net importer. This raised serious public concerns in terms of both foreign exchange and national security. Government efforts to counteract the increase in rice import by encouraging the domestic production of rice included the establishment of the National Agricultural Experiment Stations (1896), the Law of State Subsidy for Perfectural Agricultural Experiment Stations (1899) and the Arable Land Replotment Law (1899).

The efforts to develop technology to raise yield per hectare by combining indigenous techniques and modern science were successful by the beginning of this century in establishing a rather unique technology called Meiji Noho (Meiji Agricultural Methods) which was primarily based on seed improvement and higher fertilizer application with extremely labor intensive land preparation, weed and pest control, and water management. With the development and propagation of Meiji Noho, Japan could increase domestic rice supply and prevent the further decline in rice self-sufficiency during the first two decades of this century of extremely rapid industrialization and per-capita income growth, without raising the price of rice relative to the general price level (see Figure 2 and Tables 1 and 3).

From Tariff Protection to Imperial Self-Sufficiency

Voices for tariff protection on rice in terms of foreign exchange and national security considerations also began to be raised when Japan shifted to the net importer of rice. But, voices for securing cheap rice for cheap labor were equally strong. It was in the first year of the Russo-Japanese War (1904-05) when the tariff was first imposed on rice import at 15 per cent *ad valorem*.

This tariff was motivated to increase the government revenue for financing the war.[8] It was expected to be terminated at the cease of fire. Yet the landed interests strongly lobbied to preserve this tariff, and succeeded in making it a permanent tariff in the form of a specific duty of 0.64 *yen* per 60 kilogram in 1906.

Subsequently, the rice tariff became a major issue of public controversy, similar to those on the British Corn Laws and the German grain tariffs.[9] Like Malthus and Ricardo on the Corn Laws and Wagner and Brentano on the German grain tariff, Jikei Yokoi in the University of Tokyo and Tokuzo Fukuda in the Tokyo College of Commerce (Hitotsubashi University) represented the two camps. Yokoi, the foremost leader of agricultural fundamentalism, argued for the tariff on the ground of national security including the preservation of agriculture as the source of strong soldiers as well as the considerations for the balance of payment and the balance growth of agriculture and industry. Fukuda retaliated on the basis of the economic dectrine of Manchester School in favor of free trade and industrial growth. The controversy continued in the arena of the National Diet. The Imperial Agricultural Society representing landed interests and the Tokyo Chamber of Commerce representing the manufacturers and traders of export goods made strong lobbying for opposite ends.

In 1913 the rice tariff controversy in the Diet came to a conclusion with the specific duty of one yen per 60 kilograms, which can be lowred up to 0.4 yen by the government order. An important qualification was that the import of rice from overseas territories, Taiwan and Korea, were made free of duty. This decision pointed to a possibility of solving two conflicting policy goals, (a) self-sufficiency of rice and (b) supply of cheap rice for urban workers, by expanding the source of rice supply from Japan proper to overseas colonies. This policy of the imperial self-sufficiency was not deliberately adopted before Kome Sodo (Rice Riot) in 1920[10].

Increase in rice yield and production, which had kept rice import from rising, began to slow down in the mid-1910's. Technological potential in Meiji Noho was being exhausted as it was being perfected and propagated[11]. The agricultural experiment stations in their early days contributed to agricultural productivity growth by exploiting indigenous potential rather than by supplying new potential. The national experiment station gradually moved to conduct more basic research, including original crop breeding projects at the Kinai Branch by cross-breeding (1904) and at the Rikuu Branch by pure line selection (1905). Results of major practical significances lagged, however, for more than two decades.[12]

The exploitation of indigenous potential and the lag in scientific research in supplying new potential, when confronted with the expansion of demand due to World War I, resulted in a serious rice shortage and a high price of rice, causing disruptions in urban area and culminating in the Rice Riot in 1918, which swept over the major cities in Japan.

Japan was then faced with a choice between high rice prices, high cost of living and high wages on the one hand and a drain on foreign exchange by large-scale rice imports on the other. Both were unfavorable to industrial development. The reaction of the government was to organize the imperial self-sufficiency programs. Under the program titled Sanmai Zoshoku Keikaku (Rice Production Development Program), the Japanese government invested in irrigation and water control and in research and extension in order to develop and diffuse high yielding Japanes rice varieties adapted to the local ecology of Korea and Taiwan.[13] Success of this effort created the tremendous rice surplus which flooded into the Japanese market. As shown in Table 3, within 20 years from 1915 to 1935 net imports of rice from Korea to Japan rose from 170 to 1,212 thousand metric tons per year, and net imports from Taiwan rose from 113 to 705 thousand metric tons. As the result of the inflow of colonial rice the net import of rice rose from 5 to 20 percent of the domestic production.

Rice Control to Counteract Colonial Rice and Depression

The success of government program in developing Korea and Taiwan as major suppliers of rice to Japan was a mixed blessing. Such large scale imports of rice, commodity characterized by a relatively inealstic demand schedule, could be expected to lower the price and discourage the production of rice in Japan. A deterioration in the price and in the terms of trade for rice during this period would appear to be a logical consequence of the policies designed to increase imports from Korea and Taiwan.[14]

During the 1920's competition from colonial rice producers together with the deflationary policy of the government to return to the gold standard at pre-war parity depressed agricultural prices and income. Finally the World Depression hit Japan, resulting in a serious agricultural crisis. The government was compelled to rescue this situation by supporting rice prices.

Attempts to stabilize rice prices by the government purchase, sale and storage activities began to be discussed already in 1913. In 1915 the Rice Price Adjustment Order was proclaimed, but little operation was done before 1920. When the price of rice began to fall in the 1920's the Imperial Agricultural Society pressed government to adopt a rice control program, so-called "Ever-Normal Grenary Plan". This brought about the Rice Law in 1921, which empowered the government in order to adjust rice supply in the market (a) to operate the purchase, sale, storage and processing of rice within the financial limit of 2 thousand million _yen_, and (b) to reduce or increase the import duty and to restrict import from foreign countries.

In response to the rapid decline in rice prices in the late 1920's and 1930's, the Rice Law was amended in 1925, 1931 and 1932, raising the financial limit finally to 4.8 thousand mill on _yen_. In 1933 when a bumper crop caused a phenomenal surplus of rice, the Rice Law was replaced by the Rice Control Law which authorized the government to buy and sell unlimited quantity of rice at the floor and ceiling prices. The government rice control operation was extended to colonial rice.

The government storage reached the peak of 1.4 million tons at the end of 1934. After this year the balance of rice demand and supply made a dramatic turn. Increasing military involvement in China created effective aggregate demand, which expanded the demand for rice. Also, both labor and capital were diverted from productive purposes to military purposes. After the China Incident in 1937, the shortage of labor and material inputs such as fertilizer, began to be keenly felt. Government storage of rice rapidly decreased, and exhausted in 1939 by the severe drought which hit western Japan and Korea.

In the progress of the war government was forced to take measures of direct control of rice distribution, which began as the Rice

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Distribution Control Act in 1939. Increasing the number of food items were added to the list of direct control and rationing. Finally the Food Control Act was proclaimed in 1942, the second year of the Pacific War, by which nearly all items of food were placed under the strict control of the government.

III. Rice Policy in the Post-War Growth

During the 20 years of "miraculous" recovery and growth of the Japanese economy from the complete devastation of World War II, rice shifted from a major wage good critical for industrial development to a minor item in household consumption expenditure. This change prepared a condition to permit a rise in rice prices to an unprecedented level under the strong pressure of farmers requesting for parity in income and wages with urban workers. In this section we will review this process and make an appraisal of rice policy in terms of long-term historical trend.

Rice Policy for Economic Recovery

The rice problem became a critical issue in Japan more than any other time in the process recovery from the war devastation. A compulsory delivery of rice from producers at a price much below market equilibrium had to be enforced in order to maintain the subsistence of majority of urban population under acute food shortage and hyper-inflation. Consumer price for the government ration of rice was set even lower than producer price and import price.

In 1946, by the direction G.H.Q. (The General Headquarters of U.S. occupation forces) the government introduced the parity price formula for the determination of the producer price of rice. Theoretically, this formula guaranteed the same terms of trade of rice with the commodities that farmers would buy as in the base years (1934-36). However, the commodity prices taken in the calculation of the parity index were the official prices of government rationing. Since farmers had to rely on black markets to a large extent for the purchase of both production and consumption goods, the parity price did not really guarantee the "parity". In order to secure the delivery of rice at below-equilibrium prices, the Food Emergency Measure Act was promulgated in 1946, empowering the government to expropriate the undelivered rice. Also, several incentive schemes were designed, giving bonuses to the producers who completed the delivery.

The government also made substantial investments in reclamation, irrigation, drainage, agricultural research and extension. Increase in food production was considered as a necessary condition in the design for industrial recovery. In the program for the rehabilitation of industry, called Keisha Seisunfoshiki (Differential Production Scheme), the government fund was first allocated to coal mining; increased output of coal was delivered to fertilizer and iron and steel industries; increased outputs in food from fertilizers and in iron and steel were brought back to coal mining to the effect of expanding the cycle of reproduction.

As industry was rehabilitated on the basis of compulsory delivery of cheap food, agricultural production was also recovered with the increased supply of industrial inputs to agriculture. Government control on food commodities were lifted one by one; potatoes in 1949, wheat in 1952, and etc. It was planned to lift the direct control on rice in April, 1952, but this plan was withdrawn because of the dark prospect of food supply during the Korean War.

The Korean War was a big windfall to Japanese industry. Increase in military and civil procurement from the U. S. stimulated investment by raising returns to capital, and improved the balance of payment, providing the basis for the spurt of industrialization. Indus trial production recovered to the prewar level by 1953, and continued to rise in a rapid pace.

Disparity inincome and wages between agriculture and industry began to increase since the boom of the Korean War. In order to cope with this situation, the determination of rice prices by the parity index was modified in 1952 so as to be able to account for (a) lag in the level of consumption and living of rural household relative to urban households, and (b) changes in the levels of material inputs to rice production. It was later decided that the government should consult not only the parity index but also the cost of rice production in determining the producer price of rice.

In spite of these changes in price determination formula, the price of rice remained remarkably stable before 1960 (Figure 2). Meanwhile, the import of rice declined (Table 4), and the deficit the Food Control Special Account did not rise (Table 5). During the 1950's the export from Japan was still dominated by the products of labor intensive light industries such as textiles and toys. The balance of payment was the ceiling of the rate of industrial expansion and economic growth. In such situations it appears that the rice policy was successful during the 1950's in contributing to industrial development by keeping the price of a critical wage good from rising, without causing a drain on foreign exchange and an undue pressure on national budget.

This success was based on (a) increase in rice productivity and output, especially after the bumper crop in 1955, as a result of public investments in land infrastructure andin agricultural research and extension, and (b) a stability in the prices of industrial products purchased by farm producers. However, it does not seem unlikely that the stability in rice prices could be maintained despite the strong political pressure of rice producers if the industrial development were not a national goal and rice were not a critical wage good for the development.

Changing Role of Rice and Rice Policy

Unprecedented spurt of industrial development since 1960 brought the Japanese economy into a new stage. Within ten years per-capita income trebled, and reached the level of Western Europe. Both the industrial structure and the export structure were transformed to be dominated by capital intensive industries. Labor shortage became a secular feature of the economy, and the wage differentials among different sizes of enterprises and between blue-color and white-color workers were greatly reduced.

With the dramatic increase in income and wages of industrial workers, particularly low-income manual workers, their diet has rapidly changed. Before 1960, decline in the share of starchy food staples in the total calorie intake of the Japanese was mainly through the decline in such inferior grains as barley, but from 1960 the share of rice also began to decrease (Figure 1). The absolute per-capita consumption of rice began to decrease sharply from 1965 (Table 4). The share of rice in the consumption expenditure of urban worker households declined rapidly from 10.3 in 1959 to 5.6 in 1968 (Table 2). Importance of rice as a determinant of the cost of living of urban workers was drastrically reduced. Rice became no more a critical wage good for industrial development.

By 1960 disparities between agriculture and non-agriculture in net product (or income) per worker and income per capita of population had been wide open (see Column G in Table 6 and Column B/D in Table 7). It was natural that farmers tended to identify the declining price of rice relative to general prices during the 1950's as the cause for growing income disparity. Strong demand of farmers requesting for fair returns to their labor resulted in 1960 in a rice price determination formula called " The Production Cost and Income Compensation Formula".

In this formula the price of rice is determined by the cost of production at the paddy field in which yield per hectare is lower than the national average by one sigma (one standard deviation). Since rice yield perhectare is in general inversely correlated with the cost of production per unit of output, this formula implies that the price thus determined covers the cost of production of marginal producers ("marginal" in the sense of a cost lower than average by about one standard deviation). A critical point in this formula is that wages for family labor are valued by non-farm wages in order to guarantee "fair returns" to the labor of rice producers.

With this formula the producer price of rice rose rapidly, corresponding to the rise in industrial wages. It doubled from 10.4 thousand yen per 150 kilogram of brown rice (193 U.S. dollars per metric ton) in 1960 to 20.6 thousand yen (382 U.S. dollars) in 1968. The difference of producer price from import rice rose from less than 20 per cent to well over 100 per cent. As shown in Figure 2, the domestic price of rice as deflated by the general price index clearly diverted during the 1960's from a stable boundary prevailed from the Meiji period to 1960.

The Production Cost and Income Compensation Formula was designed for a goal to reduce a gap between farm and non-farm income and wages. This policy goal seems to have been satisfied with the rising prices. Relative income per worker of agriculture to manufacturing improved from from 1960 to 1968 by the rapid rise in agricultural prices relative to manufacturing prices, which more than compensated for the relative decline in physical productivity (Table 6). Needless to say that the rise in price of rice which had the share of about 40 per cent in total value production in agriculture was a major factor in accounting for the improvement in relative income for agriculture. Rise in agricultural prices together with increase in off-farm income resulted in a marked reduction in the gap in income per person and per household between agriculture and non-agriculture (Table 7).

Satisfaction of the income parity objective involved substantial loss of economic efficiency. High price of rice should have reduced consumer surplus not only by contracting the demand for rice itself but also by obstructing the shift of resources from rice to other agricultural products of rising demand such as livestock and vegetables. The support of rice prices also depressed the outmigration of agricultural labor to non-agriculture.

More conspicuous squanders were the rapidly accumulating surplus rice in government storage and the multiplying deficit from the food control program (Tables 4 and 5). Already in 1965-67 the production of rice became so much more profitable than other agricultural products (Table 8) that resources were shifted to rice production. Rice production continued to rise until it reached a record of 14.4 million tons in 1967. Meanwhile, consumption stayed stable before 1965, and turned to a rapid decline since then (Table 4), resulting in the annual addition of 2 million tons to the government rice storage. The deficit from the rice control program reached to 40 per cent of the budget of central government for agriculture and forestry, nearly 5 percent of total national budget in 1968.

How could such squander of resources and loss of economic efficiency could be tolerated during the 1960's? Certainly it was the extremely strong political pressure of farm organizations, which achieved the handsome rise in rice prices. Although the farm population has declined in the course of rapid industrial growth, electoral districts have been little changed, leaving the political weight of farm votes unchanged.[17] Rural districts have continued to be a solid block for conservatives, which the present government could not dare to lose.

Why then the equally powerful rural votes were not successful to raise the price of rice during the 1950's? Why the equally or more strong political power of landlords before the War could not achieve a comparable support on rice?. It appears that this question can only be answered in terms of decline in the role of rice as a wage good for industrial development. As we have observed, importance of rice as a determinant of the cost of living of industrial workers was greatly reduced during the 1960's. Also, due to the rise in capital intensity and the transformation in industrial structure, a rise in the cost of living and in wages became less critical for international competitive power of Japanese industry. Rice became no more a critical wage good for industrial development. This appears the reason why the government and the society could yield to the pressure of farmers for the rise in rice prices.

Prospect

In retrospect, the cost of rice support in the past decade was one of the costs for economic growth that society had to bear; to some extent, like inflation or environmental pollution, it has a trade-off with economic growth. If the price determination were left to market mechanism, there should have been a dramatic decline in rice prices, resulting in a extremely wide income disparity between rural and urban sectors. In the long run, labor and other agricultural resources would have been efficiently reallocated to the production of other agricultural commodities or to manufacturing and service industries. But, in the short run, it might have generated more social tension that the present political system could have absorbed.

By the end of the 1960's it had become apparent that the cost of rice support exceeded the limit which society could tolerate. Drain of agricultural resources as well as public funds to rice from other crops became increasingly serious. For example, in recent years dramatic rise in the prices of vegetables and fruits which now occupy a same weight in consumers' expenditures as rice became to be identified as one of major causes for the rise in consumer price index. Yet government could not appreciably increase the expenditure for the improvement in production and marketing of vegetables because of the pressure of increasing deficit of the food control program (in the budget of 1971 only 3 billion yen was allocated to the improvement of vegetable production and marketing, much less than one hundredth of the rice control expense).

Multiplying accumulation of rice surplus and the deficit of rice control program finally worked as a brake on further price hike in 1968. Government launched a program for retirement and diversion of paddy fields in 1969, partly to stop increasing the deficit and partly to counteract the resource drain to rice. Finally, it was announced this year that government set the limit of purchase of rice to 5.8 million tons; this marked a major change in policy since the Rice Control Law in 1933 when government initiated the purchase of rice in unlimited quantity. Also, government lifted the control on the consumer price of rice.

It may appear only a step from this point to shift from the direct control to an indirect control. However, powerful agricultural cooperatives with some 5 million members and 4 hundred thousand employees, organized in a pyramidal shape from village cooperatives to prefectural and national associations, would do every thing they can to stop this shift. Their marketing, storage and credit operations are critically based on the rice control program in which cooperatives are assigned as sole agents for the delivery of rice.

It is beyond speculation when the government would abandon the direct control of rice. However, it is highly unlikely that the government would yield to the pressure of farm organizations for further rise in rice prices so far as 8 million tons of surplus in the storage do not decline appreciably. For political considerations it is equally unlikely that the price will be reduced. If the price of rice would be frozen at the present level, relative profitability would rise for the crops of high income elasticity, of which the prices have now been rising rapidly, and the resources would shift from rice to those crops. But, since the gap in the returns to labor is wide open between rice and other commodities as shown in Table 8, the shift in agricultural resources away from rice would proceed only very slowly.

Also, the gap between domestic price and import price of rice would not likely to be reduced. It does seem impossible that Japan would liberalize rice trade in near future since the present storage of 8 million tons is not likely to decline rapidly at the frozen price.[18]

IV. Conclusions and Prospect

The review of history indicated that changes in rice policy in Japan since the Meiji Restoration can be consistently explained by assuming a national goal to promote industrial development by securing an elastic supply of rice, a critical wage good, to ruban workers as a basis of an elastic supply of labor to industry. This goal had to be attained without causing a drain on foreign exchange by large-scale rice import, which was also critical for industrial growth. The revision of land tax and the development of landlordism during the Meiji period worked as unconscious means to increase the delivery of rice surplus. More conscious policies were to increase price production by public investments in land infrastructure and agricultural research and extension. When domestic supply could not keep up with demand, the source of rice supply was extended to overseas colonies.

Policies for the same goal was practiced for the recovery of Japanese economy from devastation of World War II, by means of compulsory delivery and investments in land infrastructrue, research and extension. Government's rice control program during the 1950's was successful in keeping the rice price stable without increasing the import of rice, which should have contributed substantially to the post-recovery growth and capital accumulation in industry, preparing a basis for the economic transformation in the 1960's.

While industry developed rapidly on the basis of stable supply of food, agriculture was left behind, and the income disparity between farmers and urban workers increased. Farmers considered that they were ill-treated, and demanded for "fair returns" to their labor, comparable with the wages of industrial workers. When the economy and the industrial structure were transformed by the big spurt of industrial development during the 1960's, the role of rice as a wage good declined drastrically; this prepared a basis for the political pressure of agricultural producers to succeed in raising rice prices. Japanese economy grew to a stage which could tolerate the cost of price support.

In short, in a level of per-capita income in that demand schedule for rice was expanding rapidly in response to rise in income and population, the price of rice was deliberately kept stable, and when per-capita income rose to a level in that income elasticity of demand for rice turned negative and demand began to contract rapidly, rice prices were allowed to rise. This was the paradox of economics and political economy.

This historical experience of Japan is of significance to developing countries in the tropics today. These nations are attempting to convert new food production potentials emerged from the "Green Revolution" into a basis for sustained economic growth. As the Japanese experience suggests, the food production potential, if properly exploited and delivered to urban workers, can contribute to capital accumulation and development in industry by reducing the cost of labor in industrial production. Another possibility is that as the reduced cost and prices offood staples become reflected in real wage rates they will result in downward shifts in the cost schedules of traditional export products such as rubber, copra and plywood as well as new export products such as feed grains (e.g., maize in Thailand) and vegetables (e.g., asparagus and mushroom in Taiwan). If this counteracts effectively the competition from synthetics and temperate zone agricultural products, the export crop sector might again emerge as a leading sector in the tropical economy.

Whether these possibilities materialize depends, to a large extent, on (a) efficient public investments in land infrastructure, agricultural research and extension, to exploit the potential in food staples as well as to discover and develop new profitable crops, and (b) efficient organization of marketing and agrarian institutions including tax and credit to secure the delivery of food surplus at the prices that reflect shifts in the food production cost schedules. The problem of converting the potential surplus of food staples into industrial growth or the development of export crop sector while maintaining sufficient equity in welfare among rural population and between rural and urban sectors will require extreme skill for the developing countries in the tropics for the decade to come.

Table 1. Changes in the shares of agriculture in total labor force and national income, and in national income per capita in Japan, 1880-1968.

Year	Share of agriculture in: Labor force[a/] (%)	Share of agriculture in: National income[b/] (%)	Per capita income: Yen at 1934-36 constant prices[c/]	Per capita income: U.S dollars at 1958 constant prices[d/]	Annual compound rate at growth (%)
1880	77	60	52	60	-0.7
85	75	51	50	58	4.4
90	71	50	62	72	5.1
95	69	47	79	92	3.0
1900	67	45	92	107	1.8
05	65	42	101	117	3.0
10	63	40	117	136	4.1
15	58	35	143	166	3.3
20	52	31	168	195	2.2
25	50	29	188	218	0.8
30	48	22	196	227	4.5
35	45	20	245	284	
40	42	--			
1950	46	26			
55	39	21	257	298	8.9
60	31	15	301	349	8.8
65	23	12	602	698	10.1
68	19	10	803	931	

Labor force data are of years shown. Income data are of five year averages centering years shown except 1968. 1968 data are of single year figures.

a/ Number of gainful workers. Agriculture includes forestry.

b/ NDP. Agriculture includes forestry and fishery.

c/ NDP deflated by general price index (GNP implicit deflator for post-war years).

d/ National income (NNP).

Sources: Labor force: Bank of Japan (1, pp. 52-53), JEPA (17, pp. 260-261) and Umimura (27)
Income:
Hayami and Yamada (7) and JEPA (10, pp. 76-77 and pp. 90-91).

Table 2. Shares of the expenditures for food and rice in total consumption expenditure by urban worker households.

	Shares of expenditure for: All food (%)	Shares of expenditure for: Rice (%)
Blue color workers		
Around 1897	54	32
1919	44	27
1926 - 27	33	16
1931 - 33	27	11
1936 - 38	33	15
White color workers		
1920	37	18
1926 - 27	26	11
1931 - 33	24	8
1936 - 38	28	11
All urban workers		
1953	45.0	12.9
1954	45.5	12.7
1955	44.5	12.4
1956	42.9	11.9
1957	41.9	11.8
1958	41.2	11.1
1959	39.8	10.3
1960	38.8	9.5
1961	37.7	8.2
1962	36.7	7.0
1963	36.4	7.4
1964	36.0	6.6
1965	36.2	6.6
1966	35.2	6.0
1967	36.8	5.9
1968	35.5	5.6

Sources: JBS (17) and Mochida (22, p. 305)

Table 3. Production, import, and available supply of rice, five years averages, brown rice terms, 1878-1882 to 1933-1937.

	Production	Net import			Available supply		Production	Net import		
		Total	Korea	Taiwan	Total	Per capita		Total	Korea	Taiwan
	Z	K	K_k	K_f	$Q=Z+K$	$q=Q/N$		$k=K/Z$	$k_k=K_k/Z$	$k_f=k_f/Z$
	1000 m. tons					k.g.	per cent			
1878-1882	5066	-33	-	-	5033	138	100	-0.7		
83- 87	5266	-46	-	-	5220	136	100	-0.9		
88- 92	5861	-48	-	-	5813	145	100	-0.8	-	-
93- 97	5651	49	-	-	5700	137	100	0.9	-	-
98-1902	6372	206	-	-	6578	150	100	3.2	-	-
1903- 07	6943	596	-	-	7539	162	100	8.6	-	-
08- 12	7588	335	-	-	7923	161	100	4.4	-	-
13- 17	8286	406	170	113	8692	165	100	4.9	2.1	1.4
18- 22	8838	882	360	132	9720	175	100	10.0	4.1	1.5
23- 27	8700	1343	640	278	10043	170	100	15.4	7.3	3.2
28- 32	9070	1413	974	389	10483	164	100	15.6	10.7	4.3
33- 37	9414	1876	1212	705	11290	164	100	19.9	12.9	7.5

Sources:

Z - Ohkawa et. al. (25; Vol. 9, pp. 166-168)

K - Ohkawa et. al. (25; Vol. 6, pp. 150-152)

K_k and K_f - JBS (16)

N - Bank of Japan (1, pp. 12-13)

Table 4. Production, inventory change, import, available supply and consumption of rice, 1955 - 69.

	Production	Inventory change	Net import	Available supply		Net consumption[b/]		Production	Inventory change	Net import
				Total	Per capita	Total	Per capita			
	Z	I	K	$Q=Z-I+K$	$q=Q/N$	C	$c=C/N$		$i=I/Z$	$k=K/Z$
	1000 m. tons (brown rice)				k.g. (brown rice)	1000m.tons (polished rice)	k.g. (polished rice)	per cent		
1955	12385	2400	1290	11275	127	9882	111	100	19.4	10.4
56	10899	-201	558	11658	130	10077	112	100	-1.8	5.1
57	11464	-449	433	12346	135	10589	116	100	-3.9	3.8
58	11993	224	403	12172	133	10421	114	100	1.9	3.4
59	12501	411	247	12337	133	10553	114	100	3.3	2.0
60	12858	459	219	12618	135	10738	115	100	3.6	1.7
61	12419	-566	77	13062	138	11073	117	100	-4.6	0.6
62	13009	-124	182	13315	140	11256	118	100	-0.9	1.4
63	12812	-359	239	13410	139	11275	117	100	-2.8	1.9
64	12584	-275	502	13361	138	11257	116	100	-2.2	4.0
65	12409	468	1052	12993	140	10982	118	100	3.8	8.5
66	12745	921	679	12503	126	10481	106	100	7.2	5.3
67	14453	2334	364	12483	124	10361	103	100	16.1	2.5
68	14449	2428	230	12251	121	10147	100	100	16.8	1.6
69[a/]	14003	1646	-392	11965	117	9950	97	100	11.8	-2.8

[a/] Preliminary

[b/] Available supply minus quantity used for seed, feed and industrial use.

Sources: J M A F (13).

Table 5. Deficit from the food control program in relation to the total national budget and the budget for agriculture and forestry of the central government, 1951-71.

Year	Balance of the Food Control Special Account A	Budget of Central Government for: Agriculture and Forestry B	Budget of Central Government for: Total (General Account) C	Ratio of deficit of the Food Account to: Agriculture & forestry budget A/B	Ratio of deficit of the Food Account to: Total budget A/C
	billion yen			%	
1951	3.8	106.4	793.7	-3.6	-0.5
52	- 14.0	144.4	932.5	9.7	1.5
53	- 20.6	170.9	1027.2	12.1	2.0
54	- 13.0	111.8	1000.0	11.6	1.3
55	- 0.3	96.3	1013.3	0.3	0
56	- 16.0	91.3	1089.7	17.5	1.5
57	- 6.7	121.4	1184.6	5.5	0.6
58	- 2.1	105.3	1333.1	2.0	0.2
59	- 10.2	115.3	1512.1	8.8	0.7
60	- 28.5	166.9	1765.2	17.1	1.6
61	- 58.6	229.6	2107.4	25.5	2.8
62	- 62.5	250.2	2563.1	24.4	2.4
63	- 78.6	298.7	3056.8	26.3	2.6
64	-126.9	348.5	3340.4	36.4	3.8
65	-128.1	404.9	3744.7	31.6	3.3
66	-213.9	555.1	4477.1	38.5	4.8
67	-248.8	617.9	5203.4	40.3	4.8
68	-278.2	685.3	5917.3	40.6	4.7
69	-344.1 (356.6) a/	826.7	6930.9	41.6 (43.1)	5.0 (5.1)
70	-346.2 b/ (456.4) a/	992.1	8213.1	34.9 (46.0)	4.2 (5.6)
71	--- (463.4) ac/	1086.0 c/	9414.3 c/	--- (51.2)	--- (4.9)

a/ Inside of parentheses are the budget of food control including the budget for retirement and diversion of paddy field area.
b/ Balance of rice and mugi control only.
c/ Starting budget
Data provided by the Research Section, Food Board, and the Budget Section, Minister's Office, Ministry of Agriculture and Forestry.

Table 6. Changes in relative productivity and relative prices between agriculture and manufacturing, 1953-68.

Year	Net product per worker a/ (current prices): Agriculture A	Net product per worker a/ (current prices): Manufacturing B	Relative productivity (current prices) C = A/B	Index of product prices: Agriculture b/ D	Index of product prices: Manufacturing c/ E	Relative price index F = D/E	Relative productivity (constant prices) G = C/F
	1000 yen		%	1960 = 100			%
1953 - 55 av.	68	225	30	101	102	99	30
1960	98	445	22	100	100	100	22
61	111	500	22	109	100	109	20
62	122	514	24	120	98	122	20
63	130	616	21	128	99	129	16
64	146	646	23	134	99	135	17
65	167	682	24	149	99	151	16
66	191	777	25	160	101	158	16
67	245	910	27	174	102	171	16
68	290	1017	29	177	102	174	17

a/ Net domestic product at factor cost per gainful worker. Agriculture workers include forestry workers. 1968 data are preliminary.

b/ Ministry of Agriculture and Forestry index of agricultural product prices at farm gate.

c/ Bank of Japan index of wholesale prices of manufacturing products.

Sources: J E P A (10) and J B S (16).

Table 7. Changes in relative income between farm and urban worker households, 1953-1968.

Year	Farm household				Urban worker household income[a] per		Relative income per	
	Income per household			Total income per person				
	Farm Income	Off-farm income[a]	Total A	B	Household C	Person D	Household A/C	Person B/D
	1000 yen						%	
1953 55 av.	211	139	350	55	334	70	105	79
1960	239	210	449	78	491	112	91	70
1961	258	243	501	89	542	128	92	70
1962	294	287	571	103	610	146	94	71
1963	317	325	642	118	655	157	98	75
1964	350	382	732	136	732	176	100	77
1965	401	434	835	157	797	194	105	81
1966	455	493	948	182	870	215	109	85
1967	562	573	1135	221	967	240	117	92
1968	579	669	1248	247	1068	272	117	91

[a] Include transfer income.

Source: J B S (16 and 17)

Table 8. Net returns to labor (per hour) by major farm products, 1965-67 averages.

	Yen/hour	Rice = 100
Rice	306	100
Wheat	91	30
Potatoes	225	73
Sweet potatoes	140	46
Red beans	167	55
Cucumber	167	55
Tomato	181	59
Tangerine orange	346	113
Apple	177	58
Rapeseeds	119	39
Tobacco	118	38
Tea	226	74
Cocoon	153	50
Milk	145	47
Egg	182	59
Hog	137	45

Source: I M A F (116: p. 22)

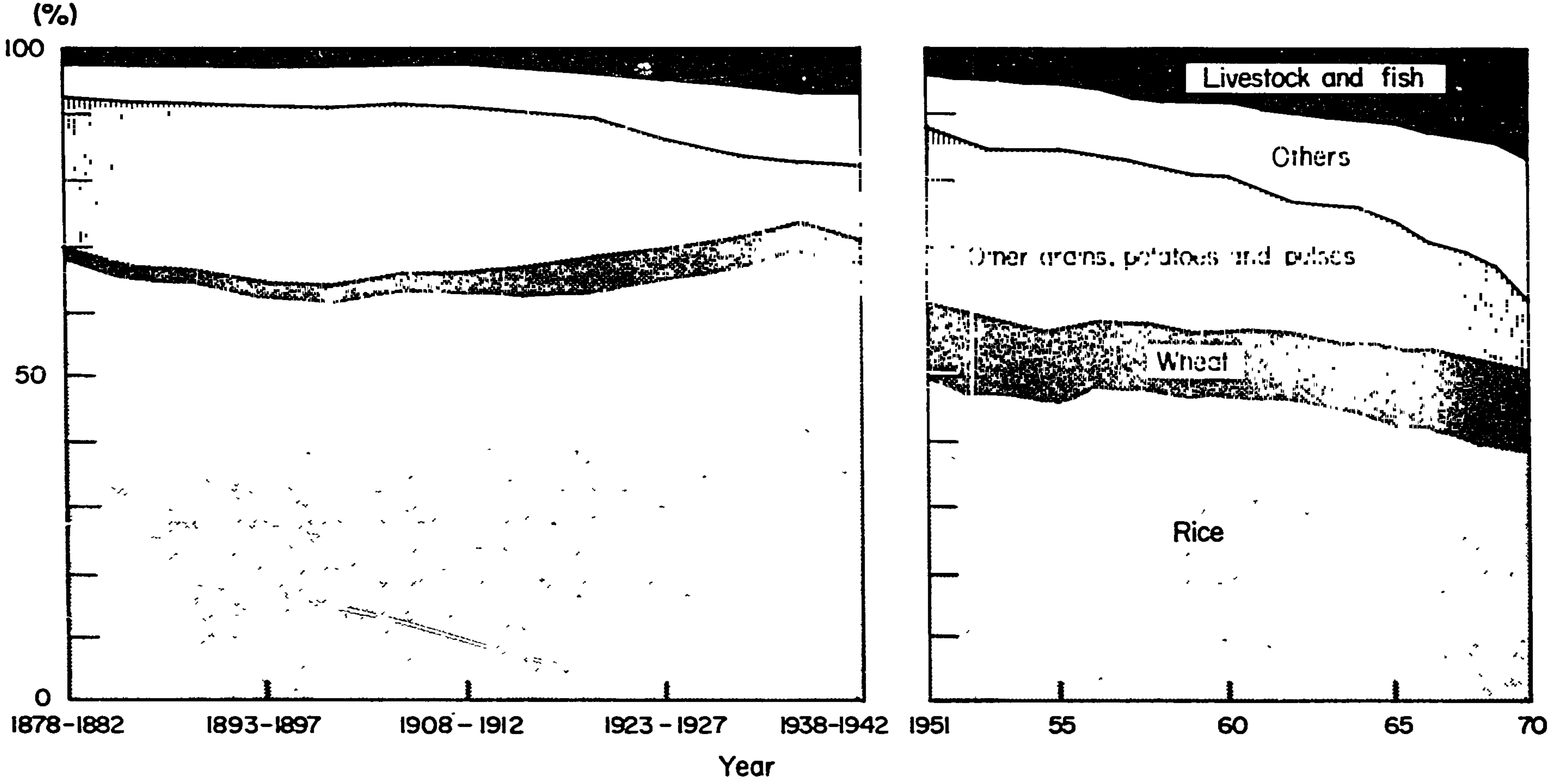

Fig. 1. Changes in the shares of various food items in the total calorie intake of the Japanese, 1878-1942 quinquennial data and 1951-1969 annual data.

Sources: JMAF [14] and Yamada and Hayami [28].

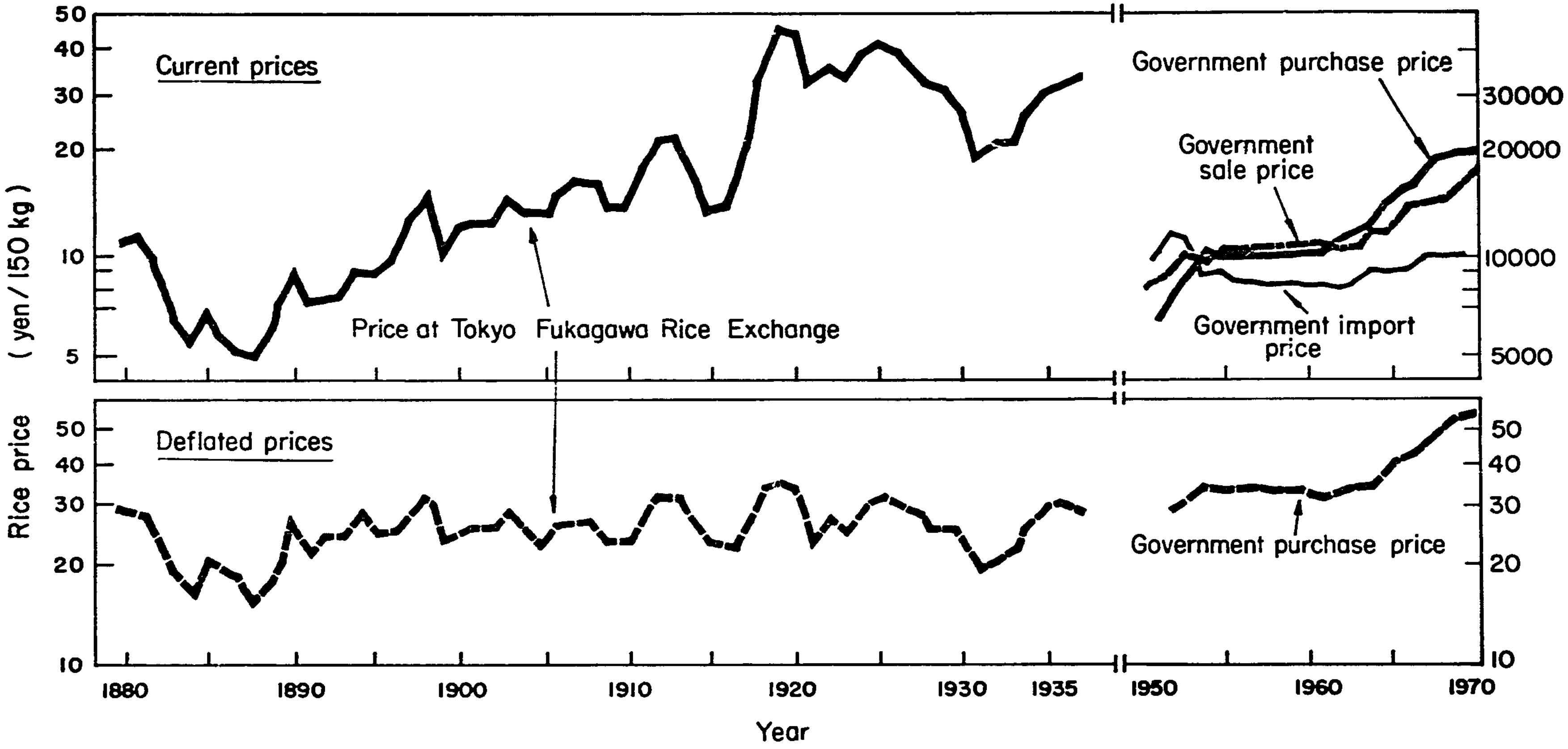

Fig. 2. Changes in rice prices, both current and deflated by the general price index (1934-36 = 100), in Japan (log-scale in brown rice term), 1880-1937 and 1951-1970.

Sources: Kayo [18, p. 514], JMAF [13] and Ohkawa [25; Vol 8, p. 134].

Footnotes

* The author wishes to thank (a) Keizo Mochida for suggestions and comments and (b) Masakutsu Akino, Kenji Konosu, Hiroaki Noake, Hirohisa Tanaka and Nobunari Tanaka for assistance in data collection.

1/ For excellent review of the history of rice policy in relation to economic growth, see Mochida (20) (21). For factual descriptions of rice policies, see Ogura (24, pp. 149-210).

2/ Such questionable restrictive assumptions as the "surplus labor at zero marginal productivity" and the "institutional wage rate" are unnecessary for the present discussion.

3/ Decline in the share of rice from before to after World War II is explained by increase in wheat consumption. The wheat eating habit was developed during the period of rice shortage through school lunch program, and etc.

4/ This deflation was named after Finance Minister Matsukata who executed the deflation policy by consolidating paper currencies in order to establish the silver standard.

5/ The tax revision on arable land was largely completed in 1873, but was not completed before 1881 on forest and wild fields.

6/ According to Max Fesca, a German soil scientist, employed by the Meiji Government, "The people of the lower class ate mainly the mixture of rice and barley prepared in the ratio of 1 to 2, or a porridge of millet and rice or of millet and barley, and, as a side dish, ate dried strips of radishes or vegetables of the season; they took almost no fish, even dried ones" (Ogura: 24, p. 182).

7/ See Chapter 7 of Hayami and Ruttan (5) and Ogura (24) for the policies for increasing productivity and output of rice. For more detailed information, see Nogyo Hattatsushi (23).

8/ This tariff also intended to appease landlords who accepted the rise in land tax for financing the War.

9/ For the vivid description of the controversy, see Mochida (20).

10/ According to Tobata, before the Rice Riot, "...development efforts in Taiwan were concentrated on sugar production and little was done in Korea. It was claimed that the development of rice production in those overseas territories should be suppressed since it was to foster the competition against Japanese agriculture...." (Nogyo Hattatsushi: 23, p. 597).

11/ See Hayami and Yamada (6).

12/ See Nogyo Hattasushi (23) or Ogura (24).

13/ For this process, see Hayami (3)

14/ For a detailed quantitative analysis, see Hayami and Ruttan (4).

15/ The most comprehensive review of rice policy and food control program during and after the war may be seen in Ministry of Agriculture and Forestry, Board of Food, (12). For concise summary, see Mochida (21) and Ogura (24).

16/ Brown rice is husked but unpolished rice. Conversion factors both from paddy to brown rice, and from brown rice to polished rice are roughly 80 per cent.

17/ There is an estimate that one vote in rural districts worth 4 to 7 votes in Tokyo. See Henmi(8, p. 200).

18/ There is even a possibility that the surplus will rise, considering the rapid decline in price consumption. According to a study conducted by the Ministry of Agriculture and Forestry, an estimate of income elasticity of demand for rice on 1960-68 time-series data is as low as minus 0.75 (JMAF:15, p.79). This implies that annual decline in rice consumption in Japan will be 7.5 per cent of total consumption or about 7 hundred thousand tons per year, assuming an annual growth rate of per-capita income of 10 per cent.

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Government Interference in the Rice Market in Taiwan

T. H. Lee*

Introduction

The government interference in the rice market started in 1942 by the reason of the shortage of food in the Japanese Empire during World War II. Compulsory collection and rationing of rice was undertaken by the Japanese government as a major part in controlling the economy.

In the immediate postwar period, although this policy of control was abandoned by the Chinese government, the problem of food shortage in Taiwan was not resolved largely because of the large influx of population from the Chinese mainland. Also, both the government's budget and the supply of production goods, such as chemical fertilizers and funds for irrigation investment, were quite limited in respect to amounts necessary for bringing about the quick recovery of agricultural production. Military pressure had inevitably led the government to seek another financial source. In 1948, the Provincial Food Bureau established a system of controlling of chemical fertilizers under which collection and distribution of chemical fertilizers were exchanged with cultivators for rice. Land reform (completed in 1953) was also combined with an apparatus designed to secure rice for government budget.

Since the government's role in the rice market was so important during the period 1950-1970, we will make a detailed analysis of government collection and distribution of rice. The principles guiding the government's retaining a broad control over rice market are: (1) the collection of enough rice to meet military and civilian requirements during the national emergency; (2) the rationing of rice to armed personnel and members of their families, public servants, miners and destitute persons; (3) the maintaining of a comparatively stable rice price throughout the year; and (4) the exporting of as much rice as possible in order to meet the gap in foreign exchange. 1/

1/ Joint Commission on Rural Reconstruction, Economic Digest Series No.3, "Food Administration in Taiwan" Taipei, 1953, p. 3.

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These measures can be divided into two stages: in the first period (1946-1950), the purpose of governmental policy was to achieve self-sufficiency in rice production to meet increasing requirements; in the second period (1950-1970), to resume export of rice after further increase of rice production on the island.

Therefore, our report will be directed toward evaluating governmental policy in relation to collection and distribution of rice.

Government Collection of Rice

How great was the amount of rice collected by the government through various methods is shown in Table 1. It is clear immediately from Table 2 that government collection controlled more than 74 percent of the total sale of rice in 1955 but it declined to 44 percent in 1970. Viewing from the percentage of total sale of rice in the total production, it has increased from 46 percent in 1956 to 54 percent in 1968 and then declined to 50 percent in 1969. Government collection occuped more than 35 percent of total rice production in 1954 and only 22 percent in 1969. This percentage was enough to dictate the rice market. Government interference in the rice market was stronger in the period 1950-1964 than the latter period 1961-1970. Conversely, cultivator's sale ratio of rice increased gradually.

Table 1. Government Collection of Rice, Taiwan, 1950-1970

Unit: M/T in brown rice

Period	Land tax and compulsory purchase	Barter exchange	Other collection through loan	Land price repayment	Total
1950	155,408	227,947	4,358	-	387,713
1951	156,996	193,543	42,544	-	393,083
1952	144,022	260,026	24,740	-	428,788
1953	141,236	278,900	50,040	26,148	496,324
1954	140,029	286,991	114,618	12,301	553,939
1955	128,011	309,982	34,346	65,324	518,739
1956	132,439	322,524	36,539	28,283	519,785
1957	143,240	348,944	21,261	21,902	535,347

Cont'd (Table 1)

Period	Land tax and compulsory purchase	Barter exchange	Other collection through loan	Land price repayment	Total
1958	145,241	339,269	19,077	41,254	544,841
1959	113,203	325,792	23,390	50,780	513,164
1960	134,061	293,102	22,626	16,458	466,247
1961	127,226	364,925	48,660	32,076	572,887
1962	143,591	381,975	41,210	29,642	596,418
1963	130,515	376,385	45,033	13,568	565,501
1964	182,753	438,110	37,350	11,435	669,648
1965	196,839	396,972	49,905	9,750	653,466
1966	153,176	449,150	30,684	3,414	636,424
1967	198,667	439,611	23,371	2,935	664,584
1968	216,103	456,104	22,811	2,480	697,498
1969	152,210	328,472	20,952	5,261	506,895
1970	197,183	280,532	19,707	1,769	499,211

Source: Provincial Food Bureau, Food Statistics Book 1950-1970 and Monthly Rice Accounting, 1950-1970.

Collection of Rice through Land Taxes

In collecting rice, the government adopted a variety of measures. Some of the devices employed included collection of rural land taxes and surtaxes in kind and compulsory purchase of rice from landowners according to land size. In Taiwan, following the practice in the mainland China, the rural land tax in kind was limited to paddy land. For rural land other than paddy fields, the tax was collected in cash. The procedure for levying the rural land tax in kind was based on the following formula:

1. Rural land tax in kind = tax unit (Yen) x land area (ha.) x 8.85 kg. (paddy rice).
2. Land surtax for prefectural public servants or defense surtax = tax unit (Yen) x land area (ha.) x 2.655 kg. (paddy rice).
3. Compulsory purchase = tax unit (Yen) x land area (ha.) x 12 kg. (paddy).

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Tax units differed according to the land grades recorded in the land registration book, showed the tax rates of land grades determined in 1943. In setting the tax rate, for every Japanese Yen 8.85 kg. of paddy was collected for tax, 2.655 kg. as a special levy for prefectural public servants, and 2.655 kg. for defense surtax. Concurrently, 12 kg. of paddy per tax rate (Yen) was to be sold to the Provincial Food Bureau at an official price which was only one-half of the wholesale market price for rice.

The government did not publish a detailed explanation regarding the quantity of paddy collected. If we compare payments of land tax during the Japanese period and in the postwar period, we can more or less determine the government's basis for taxing in the post-war period. The payment of land tax during the Japanese administration was made in cash. If cash is converted into the quantity of paddy in accordance with the average annual price, then the total quantity of paddy paid for land tax, surtax, defense tax on the paddy lands of grade 8 to 21 can be shown in the following table.[1]

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[1] C. Y. Hsu, Rural Taxation in Taiwan, Joint Commission on Rural Reconstruction, November 1952, p. 8.

Table 2. Total production, sale and government collection of rice, Taiwan, 1950 - 1970

Period	Total production (1) M/t	Total sale of rice (2) M/t	Government collection (3) M/t	(2)/(1) %	(3)/(2) %
1950	1,421,486	700,650	387,713	49.29	55.34
1951	1,484,792	733,933	393,083	49.43	53.56
1952	1,570,115	802,486	428,788	51.11	53.43
1953	1,641,557	843,596	496,324	51.39	58.83
1954	1,695,107	847,553	553,939	50.00	73.22
1955	1,614,953	775,177	518,739	45.98	74.34
1956	1,789,829	821,352	519,785	45.89	63.28
1957	1,839,009	847,599	535,347	46.09	63.16
1958	1,894,127	881,905	544,841	46.56	61.78
1959	1,856,316	842,211	513,164	45.37	60.93
1960	1,912,010	874,748	466,247	45.75	53.30
1961	2,016,276	988,505	572,887	49.03	57.95
1962	2,112,874	1,067,209	596,418	50.51	55.89
1963	2,109,037	1,050,159	565,501	49.79	53.85
1964	2,246,639	1,171,028	669,648	52.12	57.18
1965	2,348,042	1,254,203	653,466	53.41	52.10
1966	2,379,663	1,262,593	636,424	53.06	50.41
1967	2,413,791	1,273,461	664,534	52.76	52.19
1968	2,518,104	1,356,417	697,498	53.87	51.42
1969	2,321,633	1,150,187	506,895	49.54	44.07
1970	2,462,643	-	499,211	-	-

Source: Provincial Food Bureau, Food Statistics Book 1950-1970 and Monthly Rice Accounting, 1950-1970.

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Table 3. Quantity of paddy paid for land taxes per hectare, Taiwan, 1935 - 1951

Period	Grade 8 Kg.	Grade 9 Kg.	Grade 10 Kg.	Grade 11 Kg.	Grade 12 Kg.
1935 1/	156.25	128.29	105.26	87.17	70.72
1936	144.71	118.81	97.49	80.73	65.50
1937	146.49	120.28	98.69	81.73	66.31
1938	141.90	116.50	95.59	79.16	64.23
1939 1/	185.14	151.98	124.70	103.30	83.82
1940	189.01	155.16	127.31	105.46	85.57
1941	173.78	142.65	117.05	96.96	78.67
1942	164.59	135.11	110.86	91.84	74.52
1943	162,40	133,31	109.39	90.61	73.52
1944 1/	263.57	229.36	198.95	174.87	153.33
1945 2/3/	119.02	103.56	89.83	78.96	69.23 1/
1946 4/	184.08	160.185	138.945	122.130	107.085
1947 5/	239.304	208.2405	180.6285	158.769	139.2105
1948	239.304	208.2405	180.6285	158.769	139.2105
1949	239.304	208.2405	180.6285	158.769	139.2105
1950 6/	294.528	256.296	222.312	195.408	171.336
1951	294.528	256.296	222.312	195.408	171.336

Source: C. Y. Hsu, Rural Taxation in Taiwan, Joint Commission on Rural Reconstruction, Unpublished Mimeograph, 1952, p. 8.

1/ The tax rates were increased.

2/ World War II ended and Taiwan restored to China.

3/ From 1935 to 1945, the tax payment in cash was converted into paddy with the average annual price of paddy as shown in 7/.

4/ The land tax payment was revised to be made in kind.

5/ The surtax was levied and compulsory purchase of paddy began.

6/ The defense tax began.

7/ Farm price of Penlai paddy per 100 kg.

1935	¥ 12.16	1938	¥ 13.39	1941	¥ 16.13	1944	¥ 23.28
1936	13.13	1939	15.14	1942	17.03	1945	34.43-1st crop
1937	12.97	1940	14.83	1943	17.26	1945	102.60-2nd crop

Under the Japanese regulation, the determination of land tax rates was determined by the net income per hectare of the rice field. The relation of the percentage of land tax on a paddy field to the net income per hectare was in 1919 on the average 5.5 percent. It decreased to 2.8 percent in 1934 mainly because of the rapid increase in per hectare yield of rice. The average rate of land tax was adjusted to 3.2 percent in 1935 and then revised again in 1939 and 1944. The adjustment on the rate of land tax was made once every five years in Japanese period, but it was decided at 2 to 3 percent of net income on paddy field. If we include the surtaxes imposed by local government on land tax, the total payment of land tax including the surtaxes was 5.9 percent of net income for the 12th grade of paddy field and 10.6 percent of net income for the first grade of paddy field.

According to the estimate made by the Provincial Food Bureau in the postwar period, the annual yield of paddy for the first grade of paddy field was 7,873 kg per hectare and 600 kg for the 24th grade of paddy field. Therefore, the total payment of land taxes including surtax and defense tax per hectare was about 8.91 percent for the first grade of paddy field and 4.01 percent for the poorest grade of paddy field.

The bases for determining the rate of land taxes were for the Japanese administration net farm income and for the Chinese government gross farm income. If we use the income ratio of rice production which was reported in "Rice Production Survey, 1936-1960" (Provincial Department of Agriculture and Forestry) to adjust the difference of both bases, then the rate of land tax to net farm income including surtax and defense tax per hectare will be 26 percent for the first grade of paddy land and 12 percent for the 24th grade of paddy land in the postwar period. From this fact, it is clear that the rate of land tax is heavier in the postwar period than in the prewar period. Considering that per hectare yield of rice in 1955 was roughly same as the level of the prewar peak in 1938, it is reasonable to believe that land taxing in the postwar period was not based on the productivity of rice production which was adopted by the Japanese government. Since 1950, a 8.35 kg of paddy rate per hectare has been adjusted two times, lastly to 19.37 kg per hectare, corresponding to the decrease of rice collection in compulsory purchase from landowners after the land reform program.

With regard to the compulsory purchase of paddy from landowners, taxing formula was shown in footnote 3 to Table 3. The average official purchasing price of paddy for the first and second crops are compared with the wholesale market price of rice in terms of paddy at farm level in Table 4.

This collection compulsorily forces large landowners to deliver relatively large additional amounts of rice at the official low price. It is said that the official purchasing price was jointly decided by the Provincial Government and the Provincial Peoples' Assembly in consideration of general commodity prices and the living price indices of government officials at the time of decision. However, as seen in Table 4, the official purchasing price was about one-half of the wholesale market price. In view of this compulsory purchasing system of rice, we can understand the political and administrative objectives in the land reform program initiated by government. Jensen reported that actual and planned compulsory sale collections for the whole period under review were never in harmony.[1/] In order to obtain enough rice from cultivators and landlords to meet the needs of the budget, action by the government to institute other measures was inevitable.

Table 4. Annual official purchasing price and market price of paddy rice, Taiwan, 1951-70

	Official purchasing price (1)	Wholesale market 1/ price (2)	(1)/(2)
1951	0.65	0.84	0.77
1952	0.86	1.36	0.63
1953	1.26	2.14	0.59
1954	1.46	1.87	0.78
1955	1.48	2.01	0.74
1956	1.56	2.18	0.72
1957	1.63	2.30	0.71
1958	1.76	2.39	0.74
1959	1.86	2.55	0.73
1960	2.18	3.63	0.60
1961	2.77	3.99	0.69
1962	2.88	3.75	0.77
1963	2.94	3.85	0.76
1964	3.00	3.98	0.75
1965	3.08	4.01	0.77
1966	3.15	4.07	0.77
1967	3.32	4.27	0.78
1968	3.54	4.45	0.80
1969	3.73	4.44	0.84
1970	3.96	4.84	0.82

1/ Wholesale market rice of paddy rice was converted from price of polished rice with the ratio of 0.762 x 0.90.

Source: Joint Commission on Rural Reconstruction, Rice Review, January 1971, No. 56, Taipei, Taiwan.

Collection of Rice through Barter Programs

Barter programs were set up mainly in connection with chemical fertilizers, and were designed in order to collect the bulk of government rice directly from cultivators. Rice-fertilizer barter exchange could be either spot or loan, but repayment for loan was rice in kind. The barter program started with the second rice crop in 1948 and was undertaken on an area basis by the district offices of the Provincial Food Bureau, committing, however, actual distribution and collection to township farmers' associations.

The rate of fertilizer application was high for rice production in Taiwan in particular and rice farmers were also technically well trained in application of chemical fertilizers. The following table shows the change of fertilizer consumption by rice crops during the period 1938-1970.

It is very clear from columns 3 and 6 in Table 5 that per hectare rice yield and per hectare fertilizer consumption had a very close relationship. C. S. Shigh,[2] et al. have computed the regression relationship about the relative changes in two series for the period 1947-1959 as follows: $Yc = 83.716 + 0.171\ X$ $(R^2 = 0.844)$, where Yc is the relative change rate of per hectare rice yield and X the relative change rate of per hectare fertilizer consumption by rice. The equation indicates that one percent of increase in per hectare fertilizer consumption will affect the 0.171 percent of increase in per hectare yield of brown rice assuming other conditions constant. A. B. Lewis has recently computed the following multiple regression, showing the mathematical relationship between the amounts of three nutrients (N, P, K) in column 6 of Table 5, and the average rice yield in column 3 of the above table for the period 1952-1964.

1/ B. M. Jensen, Rice in the Economy of Taiwan, the Report for FOA Mutual Security Mission to China, August 1953, pp. 16-17.

2/ Chien-shen Shih, et al., An Appraisal of the Fertilizer-Rice Barter System in Taiwan, No. 11, College of Law, National Taiwan University, Taipei, Taiwan, 1961, pp. 20-25.

Table 5. Rice acreage, production and chemical fertilizer consumption by rice, Taiwan 1938-1970

Unit: brown rice

Period	Rice acreage	Per ha. rice yield	Total consumption of chemical fertilizers by rice	Per hectare consumption of chemical fertilizers	Nutrient quantity[1]		
					N	P_2O_5	K_2O
	Ha.	Kg.	M/T	Kg.	Kg.	Kg.	Kg.
1938	625,398	2,242	389,334	623	-	-	-
1939	626,131	2 088	351,088	561	-	-	-
1940	638,622	1,768	297,11[illegible]	465	-	-	-
1941	646,927	1,853	269,739	417	-	-	-
1942	616,529	1,900	226,843	368	-	-	-
1943	610,051	1,845	227,991	374	-	-	-
1944	600,688	1,778	77,047	128	-	-	-
1945	502,018	1,273	1,958	4	-	-	-
1946	564,016	1,565	74,391	132	-	-	-
1947	677,557	1,474	77,191	114	-	-	-
1948	717,744	1,469	87,028	121	-	-	-
1949	747,675	1,625	116,691	156	-	-	-
1950	770,262	1,845	231,764	301	-	-	-
1951	769,075	1,882	279,657	355	59	12	8
1952	765,729	1,998	362,117	460	66	24	10
1953	778,384	2,109	378,363	486	67	28	11
1954	776,660	2,163	460,179	593	63	29	12
1955	750,739	2,151	442,061	589	64	33	14
1956	783,629	2,204	490,281	626	65	34	14
1957	783,267	2,348	492,291	629	67	34	16
1958	778,189	2,434	500,716	643	90	35	19
1959	776,050	2,392	498,736	643	89	34	22
1960	766,409	2,495	505,579	660	96	34	26
1961	782,510	2,577	529,518	677	102	36	29
1962	794,228	2,660	582,451	733	116	34	30
1963	749,220	2,815	611,042	816	121	39	37
1964	764,935	2,937	702,635	919	137	44	39
1965	772,918	3,038	637,155	824	136	39	26
1966	788,635	3,017	672,371	853	149	36	44
1967	787,097	3,067	696,618	865	154	31	37
1968	789,906	3,188	706,070	964	161	29	34
1969	786,592	2,952	698,555	888	157	28	34
1970	776,139	3,173	693,690 [2]	894	-	-	-

Source: Data provided by Provincial Food Bureau.

[1] Before 1950, fertilizer nutrients are not ~~made~~ available.

[2] Primary estimate.

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$$Yr = 1453.49 + 2.5931\ N + 9.7037\ P + 10.2073\ K\ (R^2 = 0.98).$$

From the multiple correlation determinant R^2, it is clear that about 98 percent of the variation in rice yields was associated with variation in the fertilizer nutrients. The multiple regression equation showed that there are different degrees of multiplying effects of three fertilizer nutrients (N, P, K) on the rice yield. In the case of nitrogen, its multiplying effect is lowest at 2.5931 when one kg. of nitrogen is applied for paddy per hectare. Phosphate and Potash have 9.7307 and 10.2073 of multiplying effects respectively.[1/] Two facts should be clarified from Table 5 with respect to the close relationship between per hectare rice yield and consumption of chemical fertilizer nutrients. First, the farmers' response to fertilizer price was sensitive. According to C. S. Shih's calculation, demand equation for chemical fertilizer in the Japanese period 1930-1937 was: $\log F = 4.7376 - 1.3682 \log P \quad R = 0.771$, where F indicates the demand quantity for chemical fertilizer and P the price of chemical fertilizer. The equation expresses that one percent of increase or decrease in fertilizer price will be accompanied by 1.3682 percent of decrease or increase in fertilizer consumption. Economically speaking, price elasticity of demand for chemical fertilizer was very elastic. Farmers' response to fertilizer price was sensitive during the Japanese period. Second, fertilizer application by Taiwan farmers to rice and other crops was dependent on the supply and price of fertilizer. During the Second World War and in the postwar period, the supply of chemical fertilizer was limited and a sharp decline of total fertilizer cousumption to 1,958 m/t was seen in 1945. The per hectare yield of rice also decreased to 1,273 kg. at the same time. The domestic production of chemical fertilizer was by public enterprise

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[1/] A. B. Lewis, "The Rice-Fertilizer Barter Price and the Production of Rice in Taiwan, Republic of China" Journal of Agricultural Economics, June 1967, No. 5, Taichung, Taiwan, pp. 127-179.

and was far from being sufficient to meet the demand, and large imports of chemical fertilizers were necessary. In the postwar period, the balance was net partly by imports financed by the Mutual Security Agency and partly through imports financed by the Provincial Government. Also the source of the whole chemical fertilizer supply was completely in the hands of the government. These two facts explain why in Taiwan the government could easily adopt the fertilizer-rice barter exchange system.

The exchange rates between different fertilizers and paddy rice were pegged by the Provincial Food Bureau and are adjusted from time to time. The exchange rates in the early period are shown in detail in the following table. The exchange rate of fertilizer for paddy rice in Table 6, reflects empirical information on rice and fertilizer prices in the world and shows that the exchange rates were not determined by domestic production costs or import prices plus handling charge and custom duty but by monopolistic decisions regarding maximizing profit in consideration of farmers' demands for fertilizers.

Table 6. Rate of exchange between fertilizers and paddy Rice, Taiwan, 1948-1952

(Kg. of Ponlai paddy required in exchange for 1 kg. of various fertilizers)

Type of fertilizer	1948 2nd crop	1948 1st crop	1949 2nd crop	1949 1st crop	1950 2nd crop	1950 1st crop	1951 2nd crop	1951 1st crop	1952 2nd crop	1952 1st crop
Ammonium sulfate	1.5	1.5	1.5	1.2	1.0	1.0	1.0	1.0	1.0	1.0
Calcium superphosphate	-		0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4
Calcium cynamide	-	-	-	-	1.0	0.9	0.9	0.9	0.9	0.9
Ammonium nitrate	2.0		2.0	2.0	1.6	1.4	1.4	1.4	1.4	1.4
Potassium chloride	-	-	-	-	-	1.5	1.5	1.5	1.5	1.0
Fused phosphate	-	-	-	-	-	-	-	0.4	0.4	0.4
Calcium ammonitrate	-	-	-	-	-	-	1.0	1.0	1.0	1.0
Ammoniated superphosphate	-	-	-	-	-	0.65	0.65	0.65	0.65	0.65
Ammonium phosphate	1.9	1.9	1.8	1.5	1.3	1.3	1.3	1.3	1.3	1.3
Mixed fertilizer	-	-	-	-	-	-	1.0	1.0	1.0	1.0

Source: Compiled by RED, JCRR, based on data furnished by PFB.

This is an economically inefficient way to squeeze agriculture. The reason why the government adopted this measure to collect more rice from farmers was the fact that there was no alternative. Adjustment of the exchange rate without consideration of changes in domestic production costs and international prices seems arbitrary. The rates in the table represent the average for the total exchange. The average exchange rate for each farmer was actually different according to the quantity of different fertilizers actually acquired.

Table 7. Average exchange rate of fertilizer-paddy barter System, Taiwan, 1950 - 1958

Period	Quantity of fertilizer distributed Kg. per ha.	Average exchange ratio (quantity of paddy to be required in exchange for 1 kg. of fertilizer inc. the varying percentage of nutrients)	Quantity of paddy to be paid by farmers (per ha.) in terms of brown rice, Kg.
1950	301	1.010	234
1951	255	0.959	262
1952	461	0.871	309
1953	486	0.828	310
1954	593	0.824	376
1955	589	0.857	389
1956	626	0.840	405
1957	629	0.854	414
1958	643	0.864	428
1959	643	0.863	427
1960	660	0.849	431
1961	677	0.835	435
1962	733	0.832	488
1963	816	0.799	522
1964	919	0.792	582
1965	824	0.820	541
1966	853	0.869	593
1967	885	0.842	596
1968	894	0.833	593
1969	888	0.833	581
1970	894	-	-

Source: Data supplied by Provincial Food Bureau.

The average exchange rate decreased from 1.010 kg. in 1950 to 0.828 kg. in 1953 but increased to 0.869 kg. in 1964. Then, it decreased to 0.833 kg. in 1969. This is mostly due to variations in quantity of fertilizers and distribution of nitrogen nutrient contents in relation to potassium and phosphate content.

Considering the failure of a cotton cloth barter program and barter programs for other necessary living commodities, it is clear that the success of the fertilizer barter program was mainly due to the government's monopolistic position respecting fertilizer supply and the farmers' strong desire to obtain chemical fertilizers. M. T. Chu, the former chairman of the Provincial Farmers' Association, has assessed the profit of Provincial Food Bureau from the operation of the fertilizer barter program as shown in Table 8. 1/ The total profit of the fertilizer barter program roughly amounted to 423 million N. T. dollars (equivalent to ten and a half million U. S. dollars) each year, in which 388 million N. T. dollars is obtained from imported fertilizer and 35 million from domestic production. The above analysis discloses the fact that the primary purpose in government rice collection in connection with the fertilizer barter program was that of obtaining a high profit in order to meet budget deficit. Although the exchange rate for fertilizer and paddy was adjusted from time to time, the average rate which farmers actually paid did not change very much until 1969. Change of farmers' demand for different fertilizers made the Provincial Food Bureau establish some unfair exchange rates for scarce fertilizers. The profit per m/t of fertilizer, as seen in Table 8, ranged from NT$-789 to NT$1,270.

1/ M. T. Chu, An Assessment on Fertilizer Barter System, Nonyu, 1952, No. 3, pp. 10-12.

Table 8. An assessment on profit of Provincial Food Bureau through the operation of fertilizer-paddy barter exchange program, 1962

Fertilizers	Import and purchasing quantity	Import or purchasing price	Total value	Custom duty paid	Handling charge	Total value of cost
	M/T	NT$				
1. Imports						
Ammonium sulfate	260,000	1,869.40	486,044,000	48,604,400	97,208,800	631,857,200
Calcium super-phosphate	42,000	1,308.98	54,977,160	5,497,716	10,995,432	71,470,308
Potassium chloride	55,000	1,940.06	106,703,300	10,670,330	21,340,660	138,714,290
Ammonium phosphate	10,000	2,957.81	29,578,100	2,957,810	5,915,620	38,451,530
Potassium sulfate	8,000	2,364.21	18,913,680	1,871,368	3,782,736	24,587,784
2. Domestic production						
Ammonium sulfate	40,000	4,116	164,640,000	-	14,920,000	179,560,000
Calcium cyanamide	41,000	2,600	106,600,000	-	15,293,000	121,893,000
Calcium ammonitrate	40,000	2,700	108,000,000	-	14,920,000	122,920,000
Urea	55,000	6,250	343,750,000	-	20,515,000	364,265,000
Nitrophosphate	26,000	3,300	85,800,000	-	9,698,000	95,498,000
Calcium superphosphate	132,000	1,420	187,440,000	-	49,236,000	236,676,000
3. Total	709,000	-	1,692,446,240	69,621,624	263,825,248	2,025,693,112

(continued)

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Table 8. continued

Fertilizers	Average cost per m/t	Exchange price per m/t (based on domestic market price of rice	Profit per m/t	Total profit
		NT$		NT$
1. Imports				
Ammonium sulfate	2,430	3,700	+ 1,270	+ 330,200,000
Calcium superphosphate	1,701	1,800	+ 99	+ 4,158,000
Potassium chloride	2,522	3,200	+ 678	+ 37,290,000
Ammonium phosphate	3,845	5,000	+ 1,155	+ 11,550,000
Potassium sulfate	3,703	3,700	+ 627	+ 5,016,000
2. Domestic production				
Ammonium sulfate	4,489	3,700	- 789	- 31,560,000
Calcium cynamide	2,573	3,200	+ 227	+ 9,307,000
Calcium ammonitrate	3,073	2,200	+ 127	+ 5,080,000
Urea	6,623	7,400	+ 777	+ 42,735,000
Nitrophosphate	3,673	4,000	+ 327	+ 8,502,000
Calcium superphosphate	1,793	1,800	+ 7	+ 924,000
3. Total	-	-	-	+423,202,000

Source: Provided by Provincial Food Bureau.

The above quantity only includes the supply amount of chemical fertilizers through the barter exchange system.

The cotton cloth and other commodity barter programs have been a failure. They have never reached half of the planned goal because of the unrealistic rate fixed for exchange and decline in their market prices.

The production loan program also failed in the early period. This program might be better called a prepurchase program. The loans were allocated to farmers on the basis of rice area before planting, and repayment was made by paddy rice after harvesting. A daily interest rate of 0.05 percent was charged against the loan from the day of issuance to the day of repayment. The overdue charge was 0.2 percent per day. The exchange rate for paddy rice was based on the officially calculated price. The average price of Ponlai paddy rice between June 21 and July 10 determined the rate for loans for the first crop and the average price between December 1 and 20 that for the second crop in the central and northern areas. The program had only 13 percent actual extension of loans in 1953. The failure was due to the fact that (1) the average price of rice for repayment of the loan was too low; (2) the size of the loan allowed to individual farmers was not sufficient to meet their requirement; (3) the time allowed for repayment was too short.

Despite the failures in the commodity barter system and loan program, the Provincial Food Bureau has changed the item of barter commodities and loan condition to keep some amount of rice collection. The former includes the bartering of rice for bean cake, bean meal, bicycles, oxcarts and threshers. Those programs could be successful only when market prices of commodities were higher than the prices calculated by the exchange rate. The change of loan condition was mainly seen in the decrease in interest rate and extension of repayment period. However, the total collection of rice through the loan program rarely exceeded the amount of 30,000 m/t.

Collection through Payment of Land Price

The Land-to-the-Tiller Act stipulated that the purchase price of land from landowners for resale to tenant farmers is set at 250 percent of the total main crop yield. The tenants who have received the allocated land are required to pay the purchase price within a period of ten years in 20 installments including an interest rate of four percent per annum beginning July 1953. The Act also prescribed that payment of land price should be made in paddy rice for paddy field and in cash for dry land. Payment of purchase price to the landowner consists of 70 percent in land bonds in kind and 30 percent in public enterprise stockshares. The total amount of land purchased through this program was estimated to be about 162,000 ha. The Land Bank and Provincial Food Bureau were entrusted with the handling of the issuance of land bonds and with collection and payment of land price in kind. Through this handling of land price, the Provincial Food Bureau would hold 30 percent of land price or about 30,000 m/t of brown rice on hand for each year. As seen in Table 1, the actual collection of rice from this program fluctuated from year to year. This was mainly due to delay of payment by new cultivators or delay of drawing by the landowners. Fluctuation in stock made the actual amount of rice gained by the government unstable. To prevent irregular management of rice collection and payment, the payment period was determined as a six-month period from definite date. This program lasted to 1964 and gave some help to the government's collectinn program of rice.

Government Distribution of Rice

As mentioned above, the purpose of government collection of rice was primarily to meet the requirements of military and official servicemen including their dependents, and secondarily, to earn more foreign exchange through the export of rice. However, the success or failure of rice distribution in quantity and time would also influence the market price of rice, because the total government collection of rice, as pointed out in Table 2 has kept more than 50 percent of total rice supply in market. This amount was enough to enable the government to manipulate the market as it likes. The actual operation of rice distribution had so many multiple purposes and was so implicated, that the optimal adjustment mostly relied on the adjustment between exports and marketing stabilization sale of rice.

According to the estimate of the Joint Commission on Rural Reconstruction, about 1,780,000 persons or 20 percent of the total population received rice rations in 1952. The recipients increased through time as population increased, but per capita quantity of rice ration has not changed from the initial stage of the program. As a result of the evacuation of armed forces from the offshore islands and of military preparation for counter attack upon the mainland, the armed forces and government officials increased rapidly in number to 2,640,000 persons or 23 percent of total population in 1960. Since the government considered the substitution of wheat flour supplied by the U. S. aid program for rice to be designed for the armed forces, the total quantity of rice rationed to the armed forces decreased to some extent, but the total quantity of rice rationed to government officials and military dependents increased by 55 percent between 1950 and 1960 along with some per capita increase in the amount of rice ration. Other rice rations also increased quite remarkably. As seen in Table 2, the ratio of government collection in total rice supply to market had increased from 55.34 percent in 1950 to 74.34 percent in 1955 and then decreased to 53.30 percent in 1960 and 44.07 percent in 1969. This implies that the power of government control in the rice market increased first and decreased thereafter. This, together with the increasing responsibility of government rice rations, complicated the adjustment of rice supply to rations, sale to market, and exports.

From Table 9, it is clear that market stabilization sale and export of rice had the inverse relationship, indicating the serious conflicts of supply adjustment for the two items. Therefore, government action on the adjustment of market sale and exports of rice had to be based on accurate forecast of production and stockpiling policy.

Table 9. Distribution of rice by government, Taiwan, 1950-1970

Unit. M/T of brown rice

Period	Total	Rations to armed forces	Rations to provincial police	Rations to military dependents	Rations to government servicemen and teachers	Market stabilization sale	Export	Others*
1950	398,919	156,179	2,079	21,295	73,027	8,556	110,045	27,738
1951	402,912	199,612	1,903	8,093	67,718	5,038	103,334	16,227
1952	515,672	183,005	2,315	15,307	75,912	87,454	113,760	37,919
1953	445,859	199,113	1,962	26,750	83,498	90,000	41,216	3,320
1954	333,198	148,057	1,762	24,740	82,560	24,018	36,062	15,999
1955	514,856	159,351	1,341	28,755	87,789	43,143	169,834	24,643
1956	420,591	107,715	694	33,640	93,152	63,040	93,587	28,763
1957	542,694	137,698	3,485	32,947	96,852	62,055	181,648	28,009
1958	630,199	155,508	4,887	36,267	103,590	80,768	217,491	31,688
1959	612,215	140,305	1,939	37,635	112,024	106,845	177,849	35,618
1960	593,658	123,419	4,240	42,587	103,045	243,879	38,895	37,593
1961	537,970	123,040	3,385	41,444	104,825	151,806	72,222	41,248
1962	469,692	120,519	5,305	37,625	109,638	100,331	56,944	39,330
1963	622,855	129,151	2,874	39,885	112,486	129,413	173,269	35,757
1964	589,540	125,436	4,800	43,411	118,048	115,290	126,829	55,726
1965	777,058	126,771	4,022	46,575	122,659	141,823	293,988	41,220
1966	735,782	129,695	4,934	50,030	126,611	163,676	218,883	41,953
1967	692,343	123,584	3,793	55,217	128,248	198,442	127,404	55,655
1968	642,395	119,686	4,400	58,876	123,425	185,407	78,234	72,367
1969	409,135	121,867	4,596	61,132	103,500	28,697	30,930	58,413
1970	526,030	119,882	4,125	62,078	69,213	172,902	13,583	84,247

Source. Based on data provided by the Provincial Food Bureau.

* Includes the items of relief and sale to poor.

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Stock Position of Government and Rice Price

The following table indicates the change of year-end carry-over of rice on December 31 in relation to government collection, market sale, export and rice price. As mentioned above, about 20 to 23 percent of the total population was completely dependent upon government rice ration during the period 1952-1960. On the other hand, about 50 to 52 percent of the total population during this period were farmers whose consumption of rice largely comes from their own production except in the case of a bad crop so that the rice consumption of the remaining 21 to 28 percent of the total population or 51 to 56 percent of nonagricultural population had to rely partly upon sale of rice by landlords and farmers and partly upon government market sale. According to the survey report on commodity sale by farmers in 1960, 22.94 percent of the total sale concentrated in July, 12.13 percent in August, 8.90 percent in October, 12.53 percent in November, and 22.72 percent in December. Less than 3 percent of the total sale was made during the other months.[1/] The government market sale was undertaken during the months of January, February, March, April, and May. Therefore, government carry-over of rice at the end of the year influences greatly the price of rice from the following January to May. Farmers' carry-over of rice at the end of year is usually limited in quantity, is reserved for their own self-consumption, and so has no influence on the market price. Thus, the quantity of government carry-over of rice becomes an important factor in influencing the offseason price of rice during the months January to May. A large bulk of government carry-over of rice, as pointed out before, had oppressed the annual average price of rice at only 62 to 68 percent of general price level based on 1935-1937 period through

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[1/] Provincial Food Bureau, The Survey Report on Sale of Agricultural Products, 1961, pp. 5-8.

stabilizing the seasonal price of rice. But failure of its stockpiling policy, which was due mostly to the poor forecast of production and excess export of rice caused the price of rice to increase sharply, as for example the years 1952, 1953 and 1960 in Table 10. In terms of real price deflated by the index of prices paid by farmers, the changes of the rice price in 1952, 1953, 1960, 1961 and 1968, respectively, were 34 percent, 49 percent, 22 percent and 40 percent per annum. Viewing the changes in quantities of government carry-over of rice, export of rice, and rice price as shown in columns 4, 5, and 6 in Table 10, we can prove that stockpiling is the important role of government in the rice market. The recent increase in quantities of government carry-over of rice has been considered a serious problem of current rice policy. In relation to the current structural change of agricultural production, the present government interference in the rice market has gradually been decreased.

Conclusions

(1) In relation to the sale of rice in the period 1950-1970, government collection and distribution of rice have the most important role. The government has adopted all of the means to collect more than 50 percent of rice in market. The distribution of rice to rations, market, exports, and stock were so complicated that the price of rice suffered some reverses as a result of failure of the stockpiling policy and poor judgment on production.

(2) Mobilization of rice through government manipulation had two effects: (a) visible capital flow through physical aspect, (b) invisible capital flow through low price of rice compared with the purchasing price of nonagricultural goods. In the postwar period, the latter had a large effect on capital transfer than did the former.

(3) In this case, market incentive was not the important determinant of rice supply. Government interference in the rice market in the period 1950-1970, as seen in the previous chapter, has not given significant disturbance to farmers' allocation of resources, but rather

Table 10. Market supply, export, government carry-over, of rice and rice price, Taiwan, 1950-1970

Period	Total production	Total supply rice to market	Landlords'* and farmers' sale of rice	Government market sale	Gross export	Government carry-over at the end of year	Whole sale** price of brown rice
	M/T	M/T	M/T	M/T	M/T		NT$ per M/T
1950	1,421,486	700,650	312,937	8,558	110,045	88,905	-
1951	1,484,792	733,933	340,850	5,038	103,334	141,405	1,143
1952	1,570,115	802,466	373,698	87,454	113,760	79,586	1,839
1953	1,641,557	843,596	347,272	90,000	41,216	188,282	2,901
1954	1,695,107	847,553	293,164	24,018	36,062	420,939	2,532
1955	1,614,953	775,177	256,438	43,143	169,834	325,393	2,723
1956	1,789,829	821,552	301,567	63,040	93,587	379,455	2,955
1957	1,839,009	847,599	312,252	62,055	161,646	397,757	3,128
1958	1,894,127	881,905	337,058	80,768	217,491	322,009	3,248
1959	1,856,316	940,211	297,364	106,845	177,849	199,704	3,462
1960	1,912,018	974,748	408,501	243,679	38,895	140,058	4,921
1961	2,016,276	998,505	415,618	151,806	72,222	296,021	5,405
1962	2,112,875	1,067,209	470,791	100,331	56,944	435,815	5,089
1963	2,109,037	1,050,159	484,658	129,413	173,289	393,047	5,219
1964	2,246,639	1,171,028	501,380	115,290	126,829	496,836	5,396
1965	2,348,041	1.254,203	600,737	141,823	293,988	401,153	5,443
1966	2,379,661	1,262,593	626,169	163,676	218,883	326,776	5,516
1967	2,413,790	1,173,461	608,877	198,442	127,404	332,591	5,798
1968	2,518,103	1,356,117	658,919	185,407	78,234	413,716	6,033
1969	2,321,633	1,150,137	643,292	28,697	30,930	533,847	6,016
1970	2,462,643			172,902	-13,582	528,583	6,565

* Computed from Table 1.

** The rice price is based on the Provincial Food Bureau reports.

has contributed to a capital transfer from the agricultural sector through rice collection and distribution and also as a consequence of the fact that terms of trade do not favor the agricultural sector. Government profit gained from the rice collection and distribution has been partially returned to farmers through subsidy and grants favoring public and private investment in agriculture. Therefore, evaluation of the government's interference in the rice market will be better considered from its impact on economic growth and people's welfare. However, the chemical fertilizer-rice barter system, as discussed by A. B. Lewis recently, has gradually become the bottleneck of agricultural production by reason of inefficiency of resource allocation and the high price of chemical fertilizer. The government has also taken steps to decrease the price of chemical fertilizer and partly changed the barter-exchange system of paddy rice and chemical fertilizer since 1969. Government interference in the rice market has been taken over gradually by the free market mechanism.

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Rice: Policies and Problems

Dharm Narain*

Part I

Since rice is only one, although quantitatively the single most important, of the several cereals produced and consumed in India, the objectives of rice policy are not detachable from the policy objectives pertaining to other cereals; in fact, they are the same as the objectives of the foodgrain policy. Cast in terms of rice, these are:

(i) to make rice available especially to the vulnerable consumer at a fair price;

(ii) to provide protection to the grower against the price of rice falling to uneconomic levels;

(iii) to stimulate the production of rice so as to achieve self-sufficiency and even a certain exportable surplus; and

(iv) to raise the income levels of the rice growers, and at the same time, to make the income distribution more equitable.

The first two objectives are sought to be realized through the price and distribution policies. The price policy is implemented through two sets of administered prices: (a) minimum support prices, and (b) procurement prices. The former are designed to reduce the price uncertainty faced by the farmer so as to reduce his inhibitions in taking to new technology. The aim, however, is a modest one: to provide the farmer with an assurance that the price of the cereal would not be allowed to fall below the level which would cover its cost of production and leave a margin of profit. The genesis of procurement prices lies in the need to protect the consumer against an undue rise in prices in a situation of shortage. Since the country has been passing through a period of almost chronic shortage of foodgrains - the situation having eased only recently - it has had to build, for the purpose, a wide network of public distribution consisting of rationing and fair price shops. This network has been fed by grain procured domestically as well as from overseas, the proportions of the two varying with the intensity of the shortage. Procurement prices are the ones at which the grain has been, and is, domestically procured by the public agencies. In periods of shortage these prices have been below free market prices, or else it would not have been possible to supply grain to the vulnerable stratum at fair prices without resource to large subsidies. With improvements in the availability of foodgrains in the system, and pressures for offering support to prices at levels higher than those indicated by the minimum support prices, the distinction between the two has, in actual practice, tended to get blurred; procurement prices are in effect being made to serve the function of support prices.

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But since in a period of shortage, these have been below free market prices, the task of domestic procurement has necessitated various regulatory measures. The methods of procurement have varied from State to State as also between the different grains; in the case of rice, these have often taken the form of a levy on the producer and/or the miller. From amongst these measures, the one that has been subjected to maximum attack by the critics has been the imposition of restrictions on the movement of the grain on private account as between the Zones which themselves have varied in their geographical coverage over time. In respect of wheat these restrictions now stand removed, but in the case of rice they continue. The principal reason for their continuance is the need for a sizeable procurement of rice not only for meeting the requirements of public distribution but also for enlargement of the buffer stock of foodgrains so necessary for imparting a relative stability to prices; the rice component of the buffer is still very small. It is true that the procurement of wheat did not suffer as a result of the removal of movement restrictions, but the situation in the case of rice is different for the following reasons:

(i) unlike wheat, the output of which, of late, has shown sustained and sizeable increases, the production of rice has been relatively stagnant;

(ii) bulk of the market arrivals of wheat are concentrated within a short period of six to eight weeks - thus easily flowing into the hands of the procuring agencies -, whereas the farm disposal of rice stretches over almost the entire year; and

(iii) the lower price of imported wheat has enabled the public agencies to keep the margin between the prices at which wheat is domestically procured and those at which it is sold through the public distribution system so narrow as to make it difficult for the private trade to compete with them; a similar cushion is not available in the case of rice. 1/

The attainment of the objective of self-sufficiency in foodgrains, as also that of raising the income levels of the farmers, rests on programmes for increasing output. At the time of the formulation of the Fourth Five-Year Plan, the requirements of foodgrains for 1973-74, the closing year of the Plan, were estimated at about 127 million tons; the target was set a little higher at 129 million tons. The projection was based on an annual growth rate of 2.5 percent for population - the actual rate observed since the early 1960's -, of 3 percent for per capita consumption expenditure (corresponding to the targeted 5 to 6 percent increase in national income), an expenditure elasticity of demand (in terms of quantity as distinct from value) of 0.5 for foodgrains, and the base year requirement equated with the estimated per capital availability of grains in 1967-68. The requirements for rice, as also for wheat, were separately worked out on the same basis except that specific estimates of expenditure elasticity for the individual grains were used, the latter being 0.44 and 0.85 for rice and wheat, respectively. The output of rice was targeted to increase from 39 million tons to 52 million tons by the end of the Plan Period; the target besides providing for domestic requirements also contained a margin for exports.

Most of the addition to rice output, a little over 11 out of 13 million tons, was expected to come from increases in per hectare yields through increased use of high yielding varieties of seeds together with fertilizers and other inputs, and the rest through other programs like extension of irrigation and multiple cropping. It would thus be seen that the major thrust for the expansion of rice output was to be provided by the High Yielding Varieties Program. The program which began with the imported exotic varieties is now supported by a sizeable research effort devoted to evolving high yielding and short-duration varieties adapted to local conditions and consumer preferences. The effort is organized in the All-India Coordinated Rice Improvement Project which undertakes a broad program of plant breeding, testing, selection and production experimentation of Centres located throughout the country.2/ As a result of this effort several new varieties of rice have been recently introduced. The high yielding varieties program aims to cover some 10 million hectares - accounting for an approximate 1/4th of the present acreage under the cereal by these varieties by 1973-74. (3)

As regards the objective of reducing the inter-farmer disparities in incomes, a special program has been launched to help the small but potentially viable farmers. Under a scheme formulated as part of the Fourth Five Year Plan, the Small Farmers Development Agencies are being set up in selected districts to identify the problems of small but potentially viable farmers in their respective areas and to help provide inputs, services and credit. This will be done, to the maximum extent possible, through the existing institutions - public, cooperative and private - and local authorities. The agency may provide assistance to small farmers in respect of other services, such as land levelling, machinery and marketing. It may in addition undertake creation of irrigation facilities and custom service for the benefit of the small farmer. The agency will also draw model plans for investment and production activities to be undertaken by small farmers operating under different sets of conditions. The idea is to gain experience in these districts so as to formulate more comprehensive plans for general adoption. This scheme, to begin with, is being launched in 46 selected districts including those growing rice. For the sub-marginal farmer and the agricultural labourers about 40 projects are to be undertaken during the Fourth Five Year Plan period; the emphasis here is on enabling the sub-marginal farmers and agricultural labourers to supplement their income by taking to dairying, animal husbandry, poultry and vegetable growing. (3,17).

Part II

The impact of the programs to increase the production of rice, however, has not been much in evidence so far, 1970-71 being the first among recent years when a significant increase of about 2 million tons is expected. This addition, although representing an increase of 5 percent over the output of the cereal in 1969-70, marks a total increase of only 7½ percent over the rice output in 1964-65, the last year of peak production before the High Yielding Varieties Program was started. No wonder it has not been possible to maintain the growth rate the production of this cereal had registered over the period 1952-53 to 1964-65; rice output in the last few years has been systematically below the levels projected on the basis of this past growth rate. Indeed, the picture presents a contrast to the performance of wheat the output of which has grown at over 10 percent per annum (compound) over the period 1964-65 to 1969-70, marking a sizeable step-up over its growth rate of 3.3 percent per annum during 1952-53 to 1964-65. The contrast is reflected in the rates of expansion of the areas under the high yielding varieties of rice and wheat as well as in the additions such areas have contributed to per hectare yields (1, 5). (Tables 1, 2 & 3).

An enquiry into the reasons for this relatively slow spread of the high yielding varieties of paddy and for the lack of impact from even that spread which has already come about will help identify the problem areas where action is called for. Our experience at the field level so far is confined, by and large, to TN-1 and Tainan-3 varieties with which the program had begun and IR-8, a better variety, which was subsequently introduced but which soon displaced, to a large extent, the former varieties. While some of the factors which lie behind the phenomenon are by now well known, others are yet subjects of a continuing exploration. Many of the known factors pertain to the biological aspects of the new plant material posing problems of adaptation to the diverse conditions in which rice is grown in India. The handicaps of the imported varieties derived from their susceptibility to disease and insects, temperature sensitivity, non-photo period sensitivity and poor grain quality.

The Philippine and Taiwan varieties proved highly susceptible to virus and bacterial disease; even IR-8, although a better variety, requires considerable expenditure on plant protection. Further, this variety suffered from delayed grain maturity as a result of the cool night temperatures in certain parts of the country and this came into conflict with the timing of the existing crop rotations. The non-photoperiod sensitivity of both TN-1 and IR-8 gave rise to additional major problems.

a) The bulk of the rice crop in India is raised during the kharif season. The new varieties when raised during this season suffer in yield because of the paucity of sunshine resulting from the cloudy conditions of the monsoon period; the traditional kharif varieties, on the other hand, being photoperiod sensitive, mature and are ready for harvest during the sunny conditions after the retreat of the monsoon.

b) The early planting of TN-1 and IR-8 results in early grain maturity and early harvest which, in the southern rice-growing States, has to be undertaken during the rainy season - the worst part of the Nort-East monsoon - and, therefore, requires drying facilities. The availability of mechanical driers thus becomes a critical factor in the adoption of these varieties.

c) In most canal irrigated rice tracts of India, the common practice is to flow water from field to field, across and down the terraces. This makes the planting time different in the lower and upper fields. For the traditional varieties this does not pose a problem; irrespective of the time planting, they flower and are ready for harvest on the different terraces at about the same time. But with the new non-photo period sensitive varieties, the absence of water control at the level of the individual fields becomes a problem; the timings when water is required and needs to be drained off by the cultivators of these varieties are different from the requirements, in this respects, of their neighbours raising traditional varieties.3/

High-yielding varieties, to repeat, perform best during the dry and sunny rabi season. But IR-8 can be cultivated successfully only on land having assured water supplies. Paucity of irrigation this acts as a principal limiting factor in extending the area sown to these varieties during the rabi season - in fact, in extending the rabi crop area itself. Even in areas served by the canals, as for example in West Godavari and Tanjore, acute water shortage develops during the later part of the rabi season. IR-8, a short-duration variety when compared to the local varieties during the kharif season, turns out, in a similar comparison, to be a relatively longer-duration variety during the rabi. Assured supply of water through supplementary irrigation with a filter point or tubewell thus becomes necessary. (4)

Some of these factors constitute such constraints in the situation as prevent the farmer from taking to these varieties irrespective of their profitability; it is only through institutional action involving sizeable investments in infra-structure to ensure more efficient water control and management, enlarged facilities for mechanical drying etc. that the rigour of these contraints can be softened. Other factors like the relatively lower yields of IR-8 during the kharif season, the necessity of having to incur higher expenditure on plant protection, poor grain quality and the need for supplementary irrigation during the rabi season bear upon the profitability of these varieties to the farmer. While adaptive research in plant breeding has taken strides in tackling some of these problems - several new varieties having been released last year - IR-8 continues to dominate the scene. The incidence of the factors listed above on the profits of the farmer therefore needs to be assessed.

Some exercises (8,9) based on (a) experimental data on the response of yield to fertilizer application, (b) assumed prices of paddy, wheat and fertilizers considered approximations to actual prices, (c) the assumption that the prices of the high-yielding and local varieties of the respective cereals are the same and (d) the further assumption that there are no additional costs involved in raising high-yielding varieties except those incurred in fertilizer purchase, show that at optimal levels of fertilization the differential between the per hectare yields of IR-8 and that of the best local variety is about as impressive as that between the per hectare yields of the high-yielding and local varieties of wheat. However, IR-8 performs much better in the rabi season - yielding about 50 percent more - than in the kharif; compared to the local varieties too the yields for it are much higher - by 55 to 60 percent - in the former season than - by around 30 percent - in the latter. Further, - and this is perhaps even more significant - the farmer can reduce his risk to half by cutting down fertilizer application to half the optimal dose without losing more than ten percent in net returns per hectare, the latter calculated again without taking into account costs other than those involved in fertilizer purchase.

In a climate of uncertainty in regard to both the yield and the prices, it would therefore be quite understandable if a farmer, faced with the paucity of resources and the limited ability to take losses, keeps fertiliser consumption much below the optimal dose. Even so, if the price of IR-8 is the same as that of the local variety, the net return per hectare for the former variety remains considerably above that for the latter. But if IR-8 fetches in the market a price which is 20 percent lower than that for the local variety, the superiority of IR-8 over the local variety in terms of net returns per hectare gets considerably reduced in the rabi season, and in the kharif local variety tends to become even superior to IR-8. (Tables 4.1 and 4.2) Moreover, since IR-8 costs more to produce on a per hectare basis, even when the net return (per hectare) for it is larger, the rate of return on costs incurred - here only on fertilizer purchase - ceases to be significantly higher in the rabi season and, in the kharif, becomes even lower than for the local variety. (Table 4.2) The more fact of a lower rate of return, however, need not prevent the displacement of local varieties by IR-8. So long as the return for the latter, appropriately discounted for the higher risks involved in its cultivation, does not fall below the average of the rate of return from the local variety and that obtainable from investments elsewhere, weighted by the investment required by the local variety and that additionally required by IR-8 respectively, the farmer would be expected to maximize his total net returns and therefore, given the area available to him for cultivation, his net returns per hectare.

The foregoing suggests the need for information on (a) the rates of discount to which the prices of IR-8 realized by the farmer are subject compared to those of the comparable local varieties and (b) the additional costs and investments involved in raising IR-8.

(a) Data relating to the market prices of IR-8 and local varieties required for a study of the discount factor is meagre, but that which is available does provide evidence, in the generality of cases, of price discount attaching to the high yielding varieties. Further, considering only the cases in which the prices of IR-8 have been below those of the local varieties, the modal average of the percentage discounts works out to 7.7 for paddy and 9.5 for rice (Table 5). Apart from the fact that there have also been cases in which the discount has been absent or even a reverse situation has obtained, the above seems to suggest that price discount, by itself, might not have been so far a factor strong enough to obliterate the higher per hectare profitability of IR-8 as compared to that of the local varieties even in the kharif season, but has been high enough to significantly narrow down the margin of advantage. What appears to have been of still greater consequence perhaps is the resistance of the producer, qua a consumer, to raising the high yielding varieties of rice for self-consumption (6); the marketable surplus of rice in India constitutes only about 30 percent of its production. But with an improvement in the availability of rice over time, the factor of price discount is likely to assume a greater importance. Even at this stage, a satisfactory assessment of the incidence of this factor calls for more adequate information on prices than is currently available; there is need, in fact, for a closer link between economic and biological research. The latter must offer high yielding varieties of rice with a superior grain quality - as it has already done in the case of wheat - for, if consumer preferences are found difficult to recondition, even more difficult it would be, specially in the long-term context, to defy market realities. Jamuns and Sabarmati, amongst the new varieties of rice recently released, are claimed to possess an improved grain quality; how well they perform in the farmer's field and how high they are rated by the consumer, however, are yet to be seen.

(b) Data on prime costs of production of IR-8 and the local varieties, collected through field surveys, too is available. The surveys additionally provide information on the gross incomes of the farmer from these varieties as also on net returns per hectare. The prices implicit in the data on the values and quantities of paddy produced - apparently those realized by the farmer - reveal a rate of discount for IR-8 consistent with that revealed by our study of the market prices of this and the local varieties. Further, even though the data relate to only a few selected districts in some of the rice-growing States, they show that the net returns per hectare for IR-8 almost invariably exceed those for the local varieties; the few exceptions to the rule pertain to IR-8 grown in kharif season. In most of the cases the rate of return on the costs incurred too is higher for IR-8 than for the local varieties. And even when it is lower, it seems to be comfortably above that required to justify the replacement of the local varieties by IR-8 on the basis of the possible rate of interest on the additionaly credit required - provided it is available - for raising IR-8 (Table 6).

The incidence of the risk factor, varying as it would from region to region and from farmer to farmer, is hard to assess. Besides, the possibilities, in specific situations, of earning a rate of return from alternative lines which may be high enough to inhibit the flow of capital into the cultivation of high yielding varieties cannot be ruled out. But such opportunities are likely to be available to big farmers specially with large owned resources. In the case of the vast majority of farmers, however, what is likely to be more pertinent for the decision to switch over from the local to the high yielding varieties would be the availability of credit and the rate of interest at which it can be obtained.

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But having said this, it must be stressed that the differential between the net returns per hectare for IR-8 and the local varieties is much less in the kharif than in the rabi season, consistently with the picture disclosed by the exercises cited earlier. Thus, when the additional gain is limited, farmers, specially those with relatively modest means, may well be deterred by the higher risks attending on the cultivation of IR-8 in incurring the larger outlay required by it. This would seem to explain that of the total acreage sown to rice in the kharif season only a little more than 8 percent had been brought under the high yielding varieties by 1969-70, whereas the corresponding proportion for the rice sown in the rabi had risen as high as 75 percent. But since the bulk of this crop in India is sown in the kharif, it is not surprising that the impact on the overall yield per hectare and production of rice has not been much in evidence so far. Even though in some areas IR-8 has performed well and yielded considerably larger profits than the local varieties (2, 12), the fact remains that, in the overall, the really successful rice varieties for kharif sowings, successful in respect of yield, consumer acceptability and resistance to pests and diseases, have hitherto been wanting. Indeed, the fact that where conditions are suitable - in the rabi or on the upland fields and in areas where flooding and water logging are not major problems in the monsoon season -, the farmers have increasingly taken to the new varieties of paddy (2, 11) shows that the availability of varieties suited to specific conditions and efficient water control and management are far more important than other factors, in conditioning the spread of the new technology.

Until such varieties emerge - some varieties, claimed to be promising, have in fact been recently released for kharif sowings -, a relatively greater accent would have to be placed on encouraging the cultivation of IR-8 in the rabi season. Indeed, had the new varieties of paddy been extensively tested prior to their release, the emphasis of the program might well have been different from the very beginning.4/ Unlike wheat, however, the problem in the case of rice is not so much the allocation of the existing rabi crop area to new varieties - indeed three fourths of it, as pointed out above, has already been brought under these - as of increasing the area under the rabi crop itself. But this requires additional investment in irrigation, draught power, etc. Thus availability of credit, a critical factor in the spread of these varieties in the kharif season, becomes even more so in the rabi.

The need for additional investments brings into a sharp focus, the play of the institutional factors in inhibiting the absorption of the new technology. Small farmers - and even more so, when they are tenants - suffer from the constraint of resources in undertaking these investments (6). In many areas, the proportion of adopters of the new seeds of paddy is higher in the categories of larger farmers than in those of small ones (11, 12). Both for increasing the spread of the new varieties and for reducing income disparities between the different strata of farmers, this constraint has to be attacked through institutional credit. But the problem does not end here. It has been shown that when an operational holding - rather its individual parcels - falls below a certain size and a tubewell or a filter point is required to provide supplementary irrigation in areas otherwise served by canals, their installation becomes uneconomic for the individual farmer (4, 6).

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In such situations some institutional arrangements to provide irrigational facilities for groups of small farmers become necessary. The problem is more serious in the rice tracts where small holdings account for a much larger proportion of the cultivated area than in the wheat tracts (Table 7).

Share tenancy constitutes another hurdle in the full realization of the potential of the new seeds. An important difference between rice and wheat in this respect derives from a striking difference, revealed by some experimental data, in the behaviour of the marginal yield response to fertilizer input, in the case of the high yielding varieties of the two cereals; the marginal response (or the product declines much more sharply in the case of wheat than in that of rice. From 910 kg. of grain for the first dose (20 kg N), the marginal response for the optimum dose (which is close to 120 kg. of nitrogen) comes down to 190 kg. in the case of wheat. The rate of decline in response over the same range for rice (from 319 kg. to 131 kg.) is much smaller. (Table 8) This has an interesting implication for resource-use under share cropping. The optimum level of fertilizer use for wheat is 126.8 kg. At 120 kg. the marginal return is Rs. 144 which is considerably more than twice the marginal cost of Rs. 53 (for 20 kg. of nitrogen). Thus the optimal level for the owner-cultivator is close to that for the share cropper (sharing output on a 50:50 basis) even without cost-sharing. In the case of paddy, however, the optimum level for the share cropping is around 120 kg. of nitrogen, where the marginal cost is Rs. 37 as against the marginal return of Rs. 89, as compared to 151 kg. for the owner-cultivator, that is, about 20 percent lower.5/ On this evidence, the need for tenancy reform, at least to ensure cost-sharing becomes even greater in areas devoted to rice than in those raising wheat. The evidence, however, is not adequate enough for a firm generalization, for, there is some other experimental data which does not reveal quite the same difference in the slopes of the marginal product curves of the two cereals with respect to fertilizer use (3). The matter, therefore, deserves further investigation, for, if this difference is found to recur it would have another implication for fertilizer use.

The implication of this difference in the slopes of the marginal product curves for the two cereals is that fertilizer used for paddy becomes more sensitive to changes in prices than in the case with wheat. This implication needs to be viewed against the background of the fact that the expenditure elasticity of demand for rice is much lower than, probably around half of, that for wheat (Table 9). This suggest that for rice, the price elasticity too would be much lower than that for wheat. The prices of rice would therefore be more sensitive to changes in its output than would be the case with wheat - a conclusion which is borne out by the studies, based on time-series analysis, of the relative weights of output and other factors in explaining the behaviour of the prices of the two cereals (15, 16). In this context, if the difference between the marginal product curves for the two cereals were found to be pervasive, it could well be argued that restrictions on the movement of rice as between the different Zones would inhibit fertilizer-use in the rice surplus States by exerting a depressive effect on rice prices in these States. Even within the framework of movement restrictions - necessitated by the re-requirements of procurement as pointed out earlier, however, this adverse

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production effect can be largely contained through vigorous procurement in the rice-surplus States and narrowing of the differentials in the procurement prices fixed for these and the rice deficit States.

There resides another problem in the low expenditure elasticity of demand for rice; it makes for a lower growth rate of demand for rice compared to that for wheat. Thus, even if a breakthrough in rice were to occur in the immediate future and a growth rate for its output much in excess of that for population were realized, it is likely to hit against the barrier set - at a lower level than that for wheat - by the growth rate for the demand for rice. The problem is not immediate, for the growth rate of rice output has not risen to such levels. And even when it rises, the problem is not likely to arise for sometime because a great deal of wheat, available on concessional terms under PL 480, has over the years been pumped into the rice tracts. One would expect a considerable switch back to rice consumption, despite a certain growth in the wheat consuming habit, in these areas with an improvement in the availability of this cereal. Over a long haul, however, given the limited possibilities of the export outlet, it may become difficult to sustain a growth rate in rice output significantly above that for the demand for the cereal. The possibilities for the diversification of the production basket, in the rice tracts, would therefore need to be explored well in time for facing this problem in the longer-term context.

FOOTNOTES

1/ For objectives and price and distribution policies, see (1, 3).

2/ For details of the All-India Coordinated Rice Improvement Project, see (10).

3/ For an excellent account of the problems associated with the biological aspects of the imported high-yielding varieties of rice, see (4, 10).

4/ In fact, in view of the high degree of variability in the results from one location to another, indicating that recommendations for rates of fertilizer application at specific locations must be based on local trials, such trials, being carried out, are even now inadequate, considering the size and diversity of rice producing regions of India (9)

5/ Prices used in these calculations are: Rs. 68 per quintal for paddy, Rs. 184 per quintal for nitrogen applied in the form of urea to paddy, Rs. 76 per quintal for wheat and Rs. 265 per quintal for nitrogen applied to wheat (13, 14).

Table - 1

Actual and Projected Production of Rice and Wheat

Years	Rice		Wheat	
	Actual	Projected*	Actual	Projected*
1	2	3	4	5
1964-65	39.3	37.6	12.3	11.8
1967-68	37.6	41.3	16.5	13.0
1968-69	39.9	42.6	18.7	13.4
1969-70	40.4	43.9	20.1	13.9

* On the basis of growth rates of 3.18 per cent for rice and 3.30 per cent for wheat observed for the period of 1952-53 to 1964-65.

Source: Directorate of Economics and Statistics, Ministry of Food, Agriculture, Community Development and Cooperation, Government of India, New Delhi.

Table - 2

Area Under the High Yielding Varieties of Rice and Wheat

Year	RICE		WHEAT	
	Area ('000 hectares)	Index (1966-67-100)	Area ('000 hectares)	Index (1966-67-100)
1	2	3	4	5
1966-67	888	100.0	541	100.0
1967-68	1,785	201.0	2,942	543.8
1968-69	2,681	301.9	4,793	885.9
1969-70	4,366	491.7	6,105	1,128.1

Source: Directorate of Extension, Ministry of Food, Agriculture, Community Development and Cooperation, Government of India, New Delhi.

Table - 3

Overall Yield per Hectare of Rice and Wheat

Year	Rice		Wheat	
	Yield (Kgs. per hectare)	Index (1964-65=100)	Yield (Kgs. per hectare)	Index (1964-65=100)
1	2	3	4	5
1964-65*	1,078	100.0	913	100.0
1966-67	863	80.1	887	97.2
1967-68	1,032	95.7	1,103	120.8
1968-69	1,076	99.8	1,169	128.0
1969-70	1,073	99.5	1,209	132.4

* The last year of peak production before the introduction of High Yielding Varieties Programme.

Source : Directorate of Economics and Statistics, Ministry of Food, Agriculture, Community Development and Cooperation, Government of India, New Delhi.

Table - 4.1

Comparison of Profitability : IR-8 and Local Varieties

Season	Variety of Rice	Net return per hectare (Rs.)		
		Price Discount		
		Zero	10%	20%
1	2	3	4	5
		At optimum level of fertiliser use		
1966 Rabi	IR-8	2,323	2,052	1,782
	Local	1,481	-	-
1967 Kharif	IR-8	1,955	1,725	1,495
	Local	1,521	-	-
		At half the optimum level of fertiliser use		
1966 Rabi	IR-8	2,097	1,864	1,623
	Local	1,399	-	-
1967 Kharif	IR-8	1,845	1,629	1,426
	Local	1,486	-	-

Source: Robert W. Herdt, "Profitability of High-Yielding Wheat and Rice", Economic and Political Weekly, Review of Agriculture, Vol.IV, No.52, December 27, 1969.

Table - 4.2

Comparison of Profitability : IR-8 and Local Varieties

	Rabi		Kharif	
	No Discount	20 Per Cent Discount	No Discount	20 Per Cent Discount
1	2	3	4	5
Net Return to Fertiliser				
IR-8 (Rs./ha)	1,446	1,102	751	461
Local (Rs./ha)	544	544	536	536
"t" on differences	2.90	2.20	1.33	-
Rate of Return to Fertiliser				
IR-8 (per cent)	735	563	445	331
Local (per cent)	476	476	365	365
"t" on differences	3.45	0.94	1.49	-

Source: Robert W Herdt, "Nitrogen Response of Rice: 1968 AICRIP Trials", Economic and Political Weekly, Review of Agriculture, Vol.VI, No.13, March 27, 1971.

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Table - 5

Percentage Discounts in the Prices of IR-8 in Relation to those of Comparable Local Varieties, November 1969 to January 1971

Class Interval (Per cent discount)	Number of cases showing a discount in prices of IR-8	
	Paddy	Rice
1	2	3
0.1 - 1.0	4	1
1.1 - 2.0	5	5
2.1 - 3.0	2	6
3.1 - 4.0	-	3
4.1 - 5.0	2	-
5.1 - 6.0	3	2
6.1 - 7.0	3	7
7.1 - 8.0	6	3
8.1 - 9.0	4	5
9.1 - 10.0	-	9
10.1 - 11.0	4	3
11.1 - 12.0	-	2
12.1 - 13.0	3	2
13.1 - 14.0	2	2
14.1 - 15.0	-	1
15.1 - 16.0	1	-
16.1 - 17.0	2	2
17.1 - 18.0	1	-
18.1 - 19.0	1	-
19.1 - 20.0	1	2
20.1 and above	1	-
Total	45	55
Modal Average	7.7	9.5

Table - 6

Returns from the Cultivation of High-Yielding and Local Varieties of Paddy, 1968-69

	West Godavari (Andhra Pradesh)					
	Kharif			Rabi		
	IR-8	Local (P)	Local (NP)	IR-8	Local (P)	Local (NP)
1	2	3	4	5	6	7
1. Yield (Quintals per acre)	18.85	13.04	12.92	22.36	13.04	11.39
2. Gross return (Rupees per acre)[a]	976.64	739.57	707.52	1,213.36	757.97	650.52
3. Expenditure in cash and kind (Rupees per acre)	537.10	353.64	419.06	802.49	608.39	566.01
4. Net return (Rupees per acre)	439.54	375.73	288.46	410.87	149.58	84.51
5. Return per rupee of investment (Rupees)	0.82	1.06	0.55	0.51	0.25	0.15

	East Godavari (Andhra Pradesh)					
	Kharif			Rabi		
	IR-8	Local (P)	Local (NP)	IR-8	Local (P)	Local (NP)
1	8	9	10	11	12	13
1. Yield (Quintals per acre)	17.80	13.01	12.29	23.45	11.54	8.85
2. Gross return (Rupees per acre)[a]	877.81	699.64	662.27	1,259.43	659.29	498.07
3. Expenditure in cash and kind (Rupees per acre)	592.96	407.77	401.43	630.22	530.29	554.38
4. Net return (Rupees per acre)	284.85	291.87	260.84	629.21	129.00	(-)56.31
5. Return per rupee of investment (Rupees)	0.48	0.72	0.65	1.00	0.24	(-) 0.10

(Continued)

Table - 6 (Concluded)

Returns from the Cultivation of High-Yielding and Local Varieties of Paddy, 1968-69

	Raipur (Madhya Pradesh)			Varanasi (Uttar Pradesh)		
	Kharif			Kharif		
	IR-8	Local (P)	Local (NP)	IR-8	Local (P)	Local (NP)
1	14	15	16	17	18	19
1. Yield (Quintals per acre)	15.49	8.85	8.32	9.22	4.89	6.57
2. Gross return (Rupees per acre)[b/]	1,143.94	673.21	624.31	678.06	348.34	462.98
3. Expenditure in cash and kind (Rupees per acre)	276.63	176.38	168.76	267.94	135.15	159.93
4. Net return (Rupees per acre)	867.31	496.83	455.55	410.12	213.19	303.05
5. Return per rupee of investment (Rupees)	3.14	2.82	2.70	1.53	1.58	1.89

	Sibsagar (Assam)					
	Sali			Ahu		
	HYV [c/]	Local (P)	Local (NP)	HYV [c/]	Local (P)	Local (NP)
1	20	21	22	23	24	25
1. Yield (Quintals per acre)	19.10	9.16	8.11	14.05	6.52	3.44
2. Gross return (Rupees per acre)[a/]	1,151.83	552.31	490.78	847.00	396.85	207.52
3. Expenditure in cash and kind (Rupees per acre)	150.13	81.36	85.49	129.33	80.63	74.09
4. Net return (Rupees per acre)	1,001.70	470.95	405.29	717.67	316.22	133.43
5. Return per rupee of investment (Rupees)	6.67	5.79	4.74	5.55	3.92	1.80

a/ : Excludes return from by-product.
b/ : Includes return from by-product.
c/ : Includes IR-8.

(P) : Participants in the High Yielding Varieties Programme.
(NP) : Non-Participants.

Source : Reports on the Evaluation of the High Yielding Varieties Programme, Agro-Economic Research Centres for different States.

Table - 7

Percentage of Cultivating Households by Size-Groups of Holdings - Major Rice Growing Districts

State/District	Size Group of Holding (acres)							
	Less than 1	1-2.5	2.5-5	5-10	10-15	Above 15	Un-specified	Total
1	2	3	4	5	6	7	8	9
Andhra Pradesh								
East Godavari	18.5	30.9	20.8	16.3	7.2	7.5	..	100.0
Krishna	10.9	32.5	20.7	17.9	7.9	10.1	..	100.0
West Godavari	13.5	29.3	21.7	17.9	7.1	10.5	..	100.0
Bihar								
Santhal Parganas	11.9	31.0	30.1	19.1	4.7	3.2	..	100.0
Shahabad	13.1	19.5	23.0	23.4	9.5	11.5	..	100.0
Madhya Pradesh								
Bilaspur	5.7	22.5	25.4	25.9	10.5	10.0	..	100.0
Durg	3.9	16.7	20.1	27.7	14.5	17.1	..	100.0
Raipur	5.3	23.3	25.2	26.0	10.2	10.0	..	100.0
Orissa								
Cuttack	13.4	33.1	29.4	17.8	3.7	2.3	0.3	100.0
Sambalpur	4.1	29.1	27.9	23.2	7.6	7.9	0.2	100.0
Tamil Nadu								
South Arcot	19.3	37.1	23.7	13.2	3.6	3.0	0.1	100.0
Thanjavur	16.1	34.8	25.9	15.4	4.2	3.4	0.2	100.0
West Bengal								
Burdwan	8.8	27.0	26.8	24.5	7.2	4.4	1.3	100.0
Midnapur	22.3	35.6	23.8	13.1	3.0	1.6	0.6	100.0
24-Parganas	23.6	32.5	23.1	14.2	4.0	2.5	0.1	100.0
Haryana								
Hissar	0.3	3.2	6.7	18.2	18.0	53.0	0.6	100.0
Karnal	0.3	4.2	9.2	29.2	25.0	31.5	0.6	100.0
Rohtak	0.7	6.3	10.8	28.3	23.5	29.9	0.5	100.0
Madhya Pradesh								
Sagar	4.0	13.1	18.0	29.1	15.0	20.7	0.1	100.0
Sehore	1.5	3.0	7.7	23.1	19.3	45.4	..	100.0
Vidisha	1.8	2.6	8.8	26.1	18.9	41.8	..	100.0
Punjab								
Amritsar	0.2	5.2	11.1	32.0	22.7	27.8	1.0	100.0
Bhatinda	1.2	5.6	7.8	16.5	16.8	51.7	0.4	100.0
Ferozepur	0.3	4.1	7.5	22.9	20.4	44.5	0.3	100.0
Jullundur	0.5	4.6	9.9	33.5	24.3	26.5	0.7	100.0
Ludhiana	0.1	4.2	7.3	25.7	24.6	37.6	0.5	100.0
Patiala	0.5	5.4	8.8	25.3	22.6	37.0	0.4	100.0
Sangrur	1.0	6.0	8.5	22.1	21.0	30.8	0.6	100.0
Uttar Pradesh								
Meerut	5.0	14.0	26.2	32.1	12.6	9.3	0.8	100.0
Moredabad	7.1	23.2	28.5	27.8	7.7	5.1	0.6	100.0

Source : Census of India, 1961, Part III,
Household Economic Tables.

Table - 8

Yield Responses to Nitrogen Application for I.R.-8 (Paddy) and Sonora-64 (Wheat)

(Kgs. per hectare)

Amount of Nitrogen	Paddy (I.R.-8)			Wheat (Sonora-64)		
	Total Yield	Response Yield	Marginal Yield	Total Yield	Response Yield	Marginal Yield
	1	2	3	4	5	6
0	5870	0	0	2068	0	0
20	6189	319	319	2978	910	910
40	6471	601	282	3743	1675	765
60	6716	846	245	4364	2296	621
80	6922	1052	206	4842	2774	478
100	7092	1222	170	5175	3107	333
120	7223	1353	131	5365	3297	190
140	7317	1447	94	5410	3342	45
160	7375	1505	58	5311	3243	-99
180	7394	1524	19	5069	3001	-242
200	7375	1505	-19	4682	2614	-387

Sources: 1. I.J. Singh, T.K. Chowdhury and Dinkar Rao, "Response of Some High-Yielding Paddy Varieties to Nitrogen: An Economic Analysis", *The Indian Journal of Agricultural Economics*, Conference Number, October - December, 1968, P. 70.

2. I.J. Singh and K.C. Sharma, *Production Functions and Economic Optima in Fertilizer use for Some Dwarf and Tall Varieties of Wheat*, Research Bulletin No.5, U.P. Agricultural University, College of Agriculture, Pantnagar, February 1969, P.10.

Table - 9

Expenditure Elasticity of Demand for Rice and Wheat

Author	Area Covered	Type of Elasticity	Elasticity for	
			Rice	Wheat
1	2	3	4	5
1. Iyengar & Jain	Rural	Value	0.538	1.483 a/
	Rural	Value	0.631	1.676 b/
2. Mukherjee & Chatterjee	Rural	Value	0.633	1.536
	Urban	Value	0.240	0.682
3. Indian Statistical Institute	Rural	Quantity	0.480	1.005
	Urban	Quantity	0.345	0.423
	All-India	Quantity	0.440	0.830

a/ Adjusted

b/ Unadjusted

Note: Elasticity coefficients are based on National Sample Survey data. 1 and 2 cover 10th Round data, while 3 covers 16th Round data.

Source: 1. N.S.Iyengar & L.R.Jain, "Projections of Consumption", Economic and Political Weekly, No.29, 1969.

2. N.Mukherjee & G.S.Chatterjee, Movements in Consumer Price Index in India : Appendix on Expenditure Elasticities by N.S.Iyengar, ISI PD. Working Paper No.263 March 8, 1963.

3. Based on National Sample Survey (16th Round) data.

Table - 10

Area Planted to Rice and Other Crops, 1969-70

('000 hectares)

		Predominantly Rice growing States	Other important Rice growing States	Other States	All-India
1		2	3	4	5
Total Cultivated Area		48,238	85,354	18,168	151,760
Total Irrigated Area		14,034	16,624	2,474	33,132
Effective Crop Area		51,570	92,987	18,469	163,026
Area Under Rice	(Total	24,367	12,475	838	37,680
	(HYV	3,130	1,171	65	4,366
Area Under Wheat		1,639	13,358	1,629	16,626
Area Under Corn (Maize)		1,614	3,201	1,047	5,862
Area Under Other Foodgrains		12,906	41,086	9,413	63,402
Area Under All Foodgrains		40,523	70,120	12,927	123,570

Note: Figures in the first three rows generally relate to the year 1967-68.

Source: (i) Directorate of Economics and Statistics,

(ii) Directorate of Extension, Ministry of Food, Agriculture, Community Development and Cooperation, Government of India, New Delhi.

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(3) *Fourth Five Year Plan, 1969-74*, Planning Commission, Government of India, New Delhi, 1970.

(4) Francine Frankel, *Agricultural Modernisation and Social Change: Case Studies of Five IADP Districts*, September 1969.

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(6) Abdul N.D. Hamid, *Prospects for Increasing Agricultural Production through Intensive Cultivation - a Case Study of the Rice Economy of Thanjavur District, India*, Ph.D. Thesis to be submitted to the University of Delhi.

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(9) Robert W. Herdt, "Nitrogen Response of Rice, 1968 AICRIP Trials", *Economic and Political Weekly, Review of Agriculture*, Vol. VI, No 13, March 27, 1971.

(10) W. David Hopper and Wayne H. Freeman, "From Unsteady Infancy to Vigorous Adolescence: Rice Development," *Economic and Political Weekly, Review of Agriculture*, Vol. IV, No 13, March 29, 1969.

(11) P.K. Mukherjee and B. Lockwood, "High-Yielding Varieties Programme in India - Assessment", *28th International Congress of Orientalists*, Canberra, January 6-12, 1971.

(12) G. Parthasarathy, "Economics of IR-8 Paddy, Factors Influencing Its Adoption in a Tank Irrigated District", *Economic and Political Weekly*, Vol. IV, No 38, September 20, 1969.

(13) I.J. Singh, T.K. Chowdhury and Dinkar Rao, "Response of Some High-Yielding Paddy Varieties to Nitrogen: An Economic Analysis", *The Indian Journal of Agricultural Economics*, Conference Number, October - December, 1968.

(14) I.J. Singh and K.C. Sharma, *Production Functions and Economic Optima in Fertilizer Use for Some Dwarf and Tall Varieties of Wheat, Research Bulletin No 5*, U.P. Agricultural University, Pantnagar, U.P., February 1969.

(15) R. Thamarajakshi, "Determinants of Rice Prices", *Agricultural Situation in India*, March 1970.

(16) R. Thamarajakshi, "Determinants of Wheat Prices", *Agricultural Situation in India*, May 1970.

(17) B. Venkatappiah, *Small Farmers Development Agency: Outline of a Programme of Action*, Address delivered at the 29th Annual Conference of the Indian Society of Agricultural Economics, Waltair, December 30, 1969.

Some Observations on Economics of Cultivating High Yielding Varieties of Rice in India

Gunvant M. Desai *

In this paper some observations are made on the efforts to increase rice production in India through the introduction of high yielding varieties (HYVs) by bringing together the findings of various studies on the HYV Programme. The main concern in examining these findings has been to see the relative profitability of cultivating HYVs vis-a-vis local varieties of rice.

After the introduction of the HYV Programme in 1966-67, a number of studies were undertaken by various institutions to review its working. The main objectives of these studies were to examine (a) the response of farmers to the programme, (b) the demand for credit and inputs resulting from the introduction of the new varieties, (c) role played by various institutions in providing services required for the programme, and (d) coordination among different agencies participating in the programme (6, p.2). Consequently, the data on cost of cultivation were not collected on the lines of farm management studies. Only the information about expenditure on important items such as seed, fertiliser, hired labour was collected because the objective was only to get a general idea on the additional expenditure incurred by the cultivators for raising HYVs.

Despite the above limitation, the findings of the various studies on HYVP provide an opportunity for useful analysis.[1] The items of expenditure included in the studies cover most of the variable inputs on which expenditure is likely to go up as a result of change in the varieties. Furthermore, the findings refer to different parts of the country and three agricultural years. Thus, together they represent, perhaps, the single most important source of information on the cultivators' experience with the HYVs. These reasons gain in importance when it is recognised that, so far, much of the discussion on the relative profitability of the two varieties in India has been based on the fertiliser production functions estimated from experiment station data (for instances see 8, 9).

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[1] For a list of the studies covered in this paper, see References.

The information used in this paper refers to the kharif season during the agricultural years 1966-67, 1967-68 and 1968-69. The 16 samples of cultivators were located in 12 districts of 9 States (Figure 1). Most of these districts have above average irrigation facilities. The six variable inputs on which the analysis is based are seed, organic manure, fertiliser, pesticides, irrigation and hired labour. The comparison is between four HYVs (ADT 27, Tainan 3, TN 1 and IR 8) and the common local varieties. All samples included cultivators growing HYV (participants) as well as those not growing HYV (non-participants). Since almost all participants also grew local varieties, the HYVs are compared with the local varieties grown by the participants (Local-P) as well as by non-participants (Local-NP).

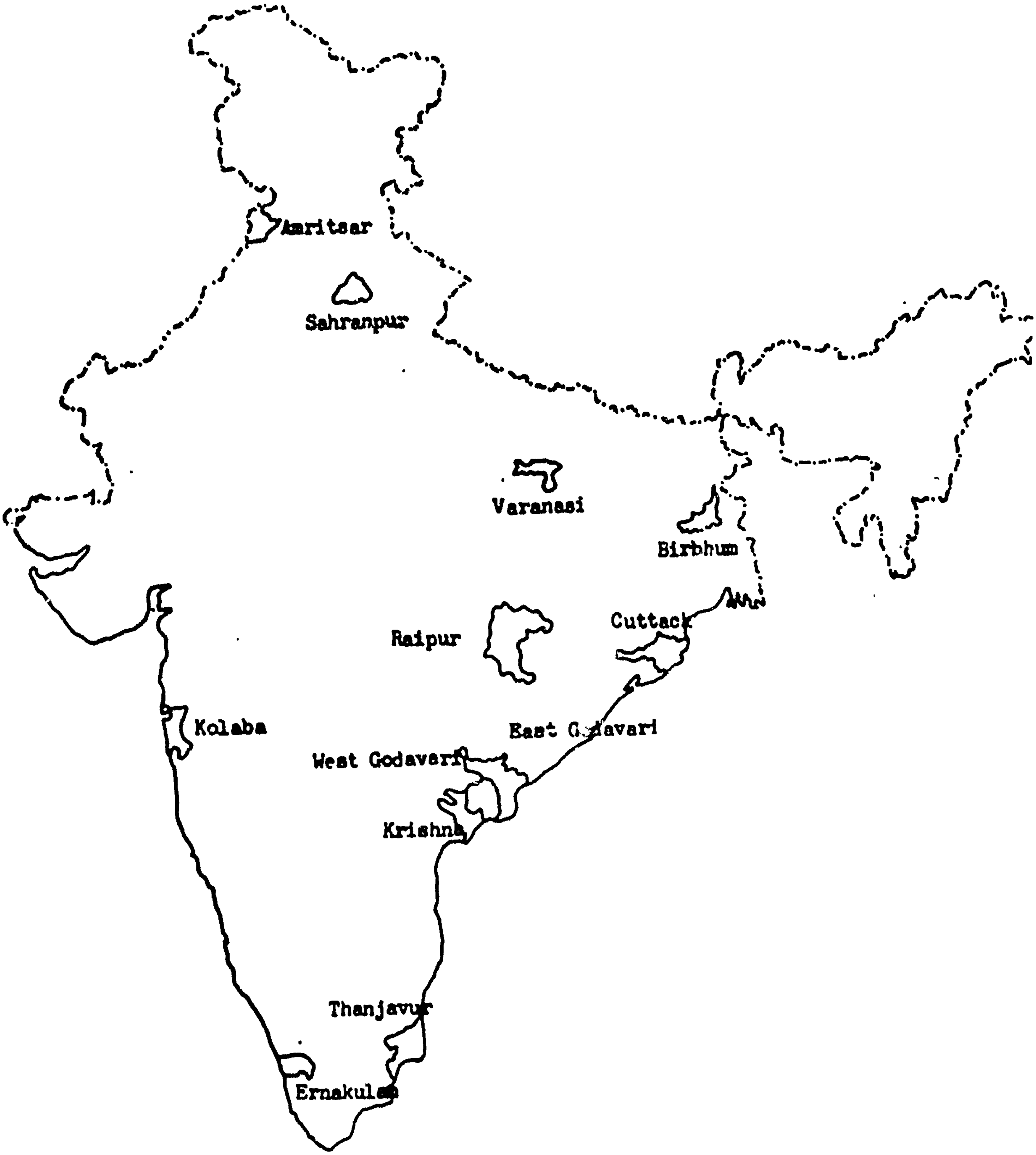
Expenditure on Local and HYV

As one would expect, expenditure on the six variable inputs taken together was higher on HYV than on local varieties (Table 1). Barring some exceptions, mainly for irrigation and hired labour, this was also true for each of the six inputs. However, in most cases over 50 percent of the difference between the total cash expenditure on the two varieties was due to fertilisers alone. Next in importance was hired labour, though in most cases it was not half as important as fertilisers in accounting for the difference between the total cash expenditure on the two varieties. Two other things may be noted from Table 1. First, in general the most important item of cash expenditure was hired labour for local varieties and fertilisers for HYVs. Second, in nearly half the cases fertiliser use on local varieties was very low (expenditure less than Rs.30 per acre).

There was an immense variation in the difference between the total expenditure on local and HYV among different samples. The increment in cash expenditure on TN 1 over local variety varied from less than 10 percent to over 300 percent (Table 2). Though the variation was relatively less in the case of IR 8, it was still quite high—from about 25 percent to over 100 percent.

The wide variation in the difference between the total expenditure on the two varieties was primarily due to the difference in fertiliser use on local and HYVs by the samples of cultivators. In some cases fertiliser use on both the varieties was very low (e.g., Varanasi) while in a few other cases it was very low on local but very high on HYV (e.g., Cuttack). There were some cases where fertiliser use was moderate on local but fairly high on HYV (e.g., Thanjavur). Finally, in some samples the difference between the expenditure on fertiliser on the two varieties was small because the level of use on local was fairly high (e.g., Amritsar). All these features were applicable to each major rice producing region.

Figure 1. Map of India showing districts where samples of cultivators were located



Source: Adapted from Government of India, Ministry of Food and Agriculture, Directorate of Economics and Statistics, Indian Agricultural Atlas, New Delhi, 1958

Table 1. Per acre expenditure on important variable inputs on local and high yielding varieties

(In rupees)

District and State	Year	Variety	Per acre expenditure on						Total
			Seed	Fertilizer	Organic manure	Pesticide	Irrigation	Hired labour	
Thanjavur, Tamil Nadu	1966-67	ADT 27	3.92	59.73	3.68	5.39	26.60	39.62	138.94
		Local (P)	1.48	38.12	1.21	2.10	27.97	47.10	117.98
		Local (NP)	2.13	36.97	0.34	4.57	18.56	45.68	108.25
	1967-68	ADT 27	7.27	84.55	8.35	3.75	-	78.76	182.68
		Local (P)	4.64	48.95	9.50	-	-	75.49	138.58
		Local (NP)	3.07	51.25	5.12	2.70	-	92.72	154.86
Ernakulam, Kerala	1966-67	Tainian 3	10.42	132.90	53.67	11.12	11.75	143.43	363.29
		Local (P)	-	64.67	23.47	5.77	10.71	119.29	223.91
		Local (NP)	-	55.44	23.74	4.38	10.84	123.38	217.79
Krishna, Andhra Pradesh	1966-67	TN 1	15.81	67.53	-	9.74	-	79.29	172.37
		Local (P)	5.59	12.43	-	-	-	53.97	71.99
		Local (NP)	6.61	4.94	-	0.13	-	47.25	58.93
Kolaba, Maharashtra	1966-67	TN 1	12.83	47.77	5.18	-	-	39.45	105.23
		Local (P)	0.58	7.00	3.06	-	-	31.43	42.07
		Local (NP)	0.59	10.70	1.60	-	-	26.22	39.11
Raipur, Madhya Pradesh	1967-68	TN 1	17.52	24.51	18.25	1.47	0.51	39.95	102.21
		Local (P)	20.63	20.25	18.83	0.40	1.12	46.82	108.05
		Local (NP)	21.73	14.18	19.26	0.29	1.30	28.62	85.38
Cuttack, Orissa	1966-67	TN 1	10.31	125.61	10.80	26.32	10.85	105.29	289.18
		Local (P)	7.92	7.33	1.40	0.38	5.51	44.94	67.42
		Local (NP)	4.26	8.85	3.26	0.26	4.40	42.99	64.02
Varanasi, Uttar Pradesh	1967-68	TN 1	15.68	25.15	17.37	1.37	8.91	90.24	158.72
		Local (P)	33.49	6.21	7.35	0.11	8.76	91.00	146.92
		Local (NP)	36.30	5.69	7.17	0.09	8.78	76.62	134.65
Saharanpur, Uttar Pradesh	1967-68	TN 1	8.20	72.52	21.73	4.93	13.77	38.08	159.23
		Local-S[a] (P)	6.02	38.20	6.82	1.29	14.73	20.46	87.52
		Local-C[b] (P)	6.12	21.71	9.45	0.24	18.03	16.44	71.99
		Local-S (NP)	6.62	19.13	25.90	-	14.46	23.98	90.09
		Local-C (NP)	6.87	9.75	15.68	-	14.74	34.30	81.25

Table 1. (Continued)

District and State	Year	Variety	Per acre expenditure on						Total
			Seed	Fertilizer	Organic manure	Pesticide	Irrigation	Hired labour	
Amritser, Punjab	1967-68	TN 1	3.54	90.36	15.17	1.13	22.78	80.86	213.84
		Local-B[c] (P)	2.96	51.66	2.77	0.40	21.70	89.52	169.01
		Local-P[d] (P)	2.58	70.83	1.46	-	26.93	103.74	205.54
		Local-D[e] (P)	2.49	40.40	4.80	0.67	24.01	82.26	154.63
		Local-B (NP)	2.39	82.15	5.70	0.07	19.00	51.97	161.28
		Local-P (NP)	2.08	82.30	6.16	-	27.31	48.91	166.76
		Local-D (NP)	2.24	39.33	10.11	0.42	25.18	55.66	132.94
West Godavari Andhra Pradesh	1967-68	IR 8	11.40	111.07	3.75	16.37	-	151.49	294.00
		Local (P)	7.67	1.93	3.26	0.33	-	125.29	138.48
		Local (NP)	8.50	3.29	3.06	0.16	-	141.18	156.19
	1968-69	IR 8	14.85	138.87	12.03	16.05	24.23	228.91	434.94
		Local (P)	11.97	17.91	9.03	1.47	15.51	192.64	248.53
		Local (NP)	12.20	37.56	18.25	2.98	19.93	192.95	283.87
East Godavari Andhra Pradesh	1968-69	IR 8	13.86	161.84	35.48	18.29	39.11	169.78	438.36
		Local (P)	11.08	19.10	12.26	3.09	15.67	141.70	202.90
		Local (NP)	12.33	30.95	21.54	2.37	10.46	151.73	229.39
Birbhum, West Bengal	1967-68	HYV[f]	27.16	127.47	-	6.39	19.05	220.35	400.92
		Local (P)	-	28.17	-	-	7.52	144.20	179.89
		Local (NP)	-	10.34	-	-	8.17	55.62	74.63
Saharanpur, Uttar Pradesh	1968-69	IR 8	8.91	95.09	22.69	8.73	20.97	134.29	290.68
		Local-B (P)	8.85	69.98	7.02	1.09	17.83	124.24	229.01
Amritser, Punjab	1968-69	IR 8	9.91	95.85	-	-	18.54	135.00	259.34
		Local-B (P)	3.13	42.90	-	-	17.24	88.09	151.33

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[a] Superior

[b] Coarse

[c] Basmati

[d] Fasmal

[e] Desi

[f] Several high yielding varieties were grown. About 85 percent of the area was under IR 8 and TN 1

Sources: Compiled from various reports on the High Yielding Varieties Programme given in the References

Table 2. Cash expenditure on local and high yielding varieties

(in Rupees)

District and State	Year	Per acre cash expenditure			Increment in expenditure on HYV as percent of	
		HYV	Local (P)	Local (NP)	Local (P)	Local (NP)
		HYV : ADT 27				
Thanjavur Tamil Nadu	1966-67	138.94	117.98	108.25	17.8	28.4
	1967-68	182.68	138.58	154.86	31.8	18.0
		HYV : Tainan 3				
Ernakulam, Kerala	1966-67	363.29	223.91	217.79	62.2	66.8
		HYV : TN 1				
Krishna, Andhra Pradesh	1966-67	172.37	71.99	58.93	139.4	192.5
Kolaba, Maharashtra	1966-67	105.23	42.07	39.11	150.1	169.0
Raipur, Madhya Pradesh	1967-68	102.21	108.05	85.38	-5.4	19.7
Cuttack, Orissa	1966-67	289.18	67.42	64.02	328.9	351.7
Varanasi, Uttar Pradesh	1967-68	158.72	146.92	134.65	8.0	18.0
Saharanpur, Uttar Pradesh	1967-68	159.23	87.52[a]	90.09[a]	81.9	76.7
			71.99[b]	81.25[b]	121.2	96.0
Amritsar, Punjab	1967-68	213.84	169.01[c]	161.28[c]	26.5	32.6
			205.54[d]	166.76[d]	4.0	28.2
			154.63[e]	132.94[e]	38.3	60.9
		HYV : IR 8				
Birbhum[f], West Bengal	1967-68	400.92	179.89	74.63	122.9	437.2
West Godavari, Andhra Pradesh	1967-68	294.00	138.48	156.19	112.3	88.2
	1968-69	434.94	248.53	283.87	75.0	52.3
East Godavari, Andhra Pradesh	1968-69	438.36	202.90	229.39	116.1	91.1
Saharanpur, Uttar Pradesh	1968-69	290.68	229.01	N.A.	26.9	N.A.
Amritsar, Punjab	1968-69	259.34	151.33	N.A	71.4	N.A.

[a] Local superior

[b] Local coarse

[c] Basmati

[d] Pasmal

[e] Desi

[f] Several high yielding varieties were grown. About 85 percent of the area was under IR 8 and TN 1

Sources: Compiled from various reports on the High Yielding Varieties Programme given in the References

Yield of Local and HYV

The yields of both local and HYV varied widely among the samples of cultivators (Table 3). Of the four HYVs, IR 8 performed better than the other three both in terms of the level of yield and variation in it. There was a close association in the yields of local and HYV. The sample in which the yield of HYV was high was also the sample with relatively high yield of the local variety and vice versa. This, however, is not surprising because the HYV would give fairly high yields only under good physical conditions. Clearly, under similar conditions the local varieties will also have relatively high yields.

The other thing which clearly emerges from Table 3 is the lack of uniformity in the comparative performance of the two varieties. At one extreme, in four samples, the yield of HYV (TN 1) was lower than that of local varieties. But at the other extreme, in three samples (TN 1 and IR 8), it was more than double that of local variety. In more than half the cases it was less than 50 percent higher and these cases included all four high yielding varieties.

Profitability of Cultivating HYV vis-a-vis Local Variety

It is not possible to compare the net revenue of the two varieties because complete data on cost of cultivation are not available. However, one can compare the difference in the total revenue of the two varieties with the difference in the expenditure on the six inputs. Although this comparison will not give a precise measure of the difference in the profitability of cultivating the two varieties, it will reveal if the increment in the total revenue due to varietal change was large enough to cover at least the increment in the total expenditure on the six inputs considered here. Also, the magnitude of the difference between the two increments will give an indication of the relative profitability of the two varieties because the six inputs cover most of the items on which expenditure is likely to go up as a result of change in the varieties.

Table 4 shows the increment in yield, total revenue, and expenditure on six inputs on HYVs over local varieties. The increment in total revenue of HYV over local could be estimated for 9 of the 16 samples because the information on prices of paddy realised by cultivators is not available for the others.

In four out of nine samples the increment in revenue of HYV over local was greater than the increment in expenditure on the six inputs (Table 4). The HYVs grown in these samples were ADT 27, TN 1 and IR 8. However, there was an important difference in the "positive"

Table 3. Yields of high yielding and local varieties

(In 100 kgs. of paddy per acre)

District and State	Year	Yield of			Increment in yield of HYV as percent of	
		HYV	Local (P)	Local (NP)	Local (P)	Local (NP)
		HYV : ADT 27				
Thanjavur, Tamil Nadu	1966-67	12.28	7.70	N.A.	59.5	N.A.
	1967-68	14.01	11.35	10.86	23.4	29.0
		HYV : Tainan 3				
Ernakulam, Kerala	1966-67	13.21	10.30	7.63	28.3	73.1
		HYV : TN 1				
Krishna, Andhra Pradesh	1966-67	17.01	15.99	16.11	6.4	5.6
Kolaba, Maharashtra	1966-67	4.76	5.85	5.62	-18.6	-15.3
Raipur, Madhya Pradesh	1967-68	3.20	7.92	7.22	-59.6	-55.6
Cuttack, Orissa	1966-67	17.44	8.50	N.A	105.1	N.A.
Varanasi, Uttar Pradesh	1967-68	6.18	6.20	6.39	- 0.3	- 3.3
Sanranpur, Uttar Pradesh	1967-68	14.18	9.99[a]	8.63[a]	41.9	64.3
			7.40[b]	5.93[b]	91.6	139.1
Amritsar, Punjab	1967-68	10.65	11.59[c]	10.96[c]	- 8.1	- 2.8
			13.00[d]	11.98[d]	-18.1	-11.1
			11.15[e]	11.16[e]	- 4.5	- 4.6
		HYV : IR 8				
Birbhum[f], West Bengal	1967-68	14.17	11.56	10.25	22.6	38.2
West Godavari, Andhra Pradesh	1967-68	23.02	14.64	11.45	57.2	101.1
	1968-69	25.13	17.38	17.22	44.6	45.9
East Godavari, Andhra Pradesh	1968-69	23.73	17.34	16.39	36.9	44.8
Sahranpur, Uttar Pradesh	1968-69	18.26	11.75[c]	N.A	55.4	N.A
Amritser, Punjab	1968-69	9.02	5.32	N.A	69.5	N.A

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[a] Local superior

[b] Local coarse

[c] Basmati

[d] Pasmal

[e] Desi

[f] Several high yielding varieties were grown. About 85 percent of the area was under IR 8 and TN 1

Sources: Compiled from various reports on the High Yielding Varieties Programme given in the References

Table 4. Increments in yield, total revenue and expenditure on high yielding over local varieties (Yield in 100 kgs. of paddy and revenue and expenditure in Rupees per acre)

District and State	Year	Increment in yield of HYV over		Increment in total revenue of HYV over		Increment in expenditure on HYV over		Col.(5) minus Col.(7)	Col.(6) minus Col.(8)
		Local (P)	Local (NP)	Local (P)	Local (NP)	Local (P)	Local (NP)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
HYV : ADT 27									
Thanjavur, Tamil Nadu	1966-67	4.58	b	189.53	b	20.96	30.69	168.57	b
	1967-68	2.66	3.15	b	b	44.10	27.82	b	b
HYV : Tainan 3									
Ernakulam, Kerala	1966-67	2.91	5.58	39.23	294.59	139.38	145.50	-100.15	149.09
HYV : TN 1									
Krishna, Andhra Pradesh	1966-67	1.02	0.90	17.83	12.83	100.38	113.44	- 82.55	-100.61
Kolaba, Maharashtra	1966-67	-1.09	-0.86	-74.05	-75.69	63.16	66.05	-137.21	-141.74
Raipur, Madhya Pradesh	1966-67	-4.72	-4.02	b	b	- 5.84	16.83	b	b
Cuttack, Orissa	1966-67	8.94	b	482.76	b	221.76	225.16	261.00	b
Varanasi, Uttar Pradesh	1967-68	-0.02	-0.21	b	b	11.80	24.07	b	b
Sahranpur, Uttar Pradesh	1967-68	4.19[c]	5.55[c]	b	b	71.71	69.14	b	b
		6.78[d]	8.25[d]	b	b	87.24	77.98	b	b
Amritsar, Punjab	1967-68	-0.94[e]	-0.31[e]	b	b	44.83	52.56	b	b
		-2.35[f]	-1.33[f]	b	b	8.30	47.08	b	b
		-0.50[g]	-0.51[g]	b	b	59.21	80.90	b	b
HYV : IR 8									
Birbhum[h], West Bengal	1967-68	2.61	3.92	b	b	221.03	326.29	b	b
West Godavari, Andhra Pradesh	1967-68	8.38	11.57	b	b	155.52	137.81	b	b
	1968-69	7.75	7.91	237.20	268.98	186.41	151.07	50.79	117.91
East Godavari, Andhra Pradesh	1968-69	6.39	7.34	178.10	215.61	235.46	208.97	-57.36	6.64
Sahranpur, Uttar Pradesh	1968-69	6.51[e]	b	115.23	b	61.67	b	53.56	b
Amritsar, Punjab	1968-69	3.70	b	90.70	b	108.01	b	-17.31	b

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[a] The following prices (in Rupees per 100 kgs. of paddy) are used in calculations: Thanjavur: HYV 43.50, Local (P) 44.76; Ernakulam: HYV 80.06, Local (P) 98.87, Local (NP) 100.00; Krishna: HYV 40.21, Local (P) 41.66, Local (NP) 41.66; Kolaba: HYV 54.94, Local (P) 57.36, Local (NP) 60.00; Cuttack: HYV 54.00, Local (P) 54.00; West Godavari: HYV 38.86, Local (P) 42.54, Local (NP) 41.09; East Godavari: HYV 36.99, Local (P) 40.35, Local (NP) 40.40; Sahranpur: HYV 52.03, Local (P) 71.05; Amritsar: HYV 42.50, Local (P) 55.00.

[b] Not calculated because of lack of information

[c] Local variety superior

[d] Local variety Coarse

[e] Local variety Basmati

[f] Local variety Parmal

[g] Local variety Desi

[h] Several HYVs were grown. About 85 percent of the area was under IR 8 and TN 1

returns on HYV over local in the case of ADT 27 and TN 1 on the one hand and IR 8 on the other.[2] While difference between the two increments was substantial for ADT 27 (Thanjavur) and TN 1 (Cuttack), it was relatively small for IR 8 (West Godavari and Sahranpur), It is necessary to note the size of the difference between the increments in revenue and expenditure because only six inputs are considered here while calculating the additional expenditure on HYV. Inclusion of the remaining items of cost would reduce the difference between the increments in revenue and expenditure because on items such as traction labour and interest on working capital the expenditure on HYVs would be higher than on local.

The reasons behind substantially high positive returns on ADT 27 and TN 1 were quite different. In Thanjavur ADT 27 was significantly more profitable than local in spite of relatively small gain in yield because the increment in expenditure on HYV was less than 20 percent. On the other hand, TN 1 in Cuttack was substantially more profitable than local despite over 300 percent increase in expenditure because its yield was more than double that of local.

In West Godavari and Sahranpur the yield of IR 8 was significantly higher than that of local but the returns on HYV over local were small. In West Godavari this was mainly due to the large additional expenditure on the HYV while in Sahranpur it was due to the price of IR 8 being much lower than that of local (a superior fine variety, Basmati).

In the other five of the nine samples for which a comparison between increments in revenue and expenditure is possible, the cultivation of HYVs was less profitable than local. The HYVs grown in these samples were TN 1, Tainan 3 and IR 8. The main reasons behind HYVs being less profitable than local for these samples were of three types: (1) In Kolaba and Krishna the yield of TN 1 was virtually no different from the yield of local despite higher expenditure on HYV. (2) In two other cases (Tainan 3 in Ernakulam and IR 8 in Amritsar) there was some improvement in the yield of HYV over that of local but the prices of HYVs were substantially lower than those of the local varieties.[3] (3) In East Godavari, the improvement in the yield of IR 8 over local was fairly high but it was not high enough to offset the substantial additional expenditure on the six inputs.

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[2] Returns on HYV over local are called "positive" when the increment in total revenue of HYV over local is greater than the increment in expenditure on the six inputs. In the opposite case, they are called "negative."

Although the information on prices realised by seven samples of cultivators is not available, it is easy to see that in three of these samples (Raipur, Varanasi and Amritsar) the cultivation of HYV must have been less profitable than local because the yield of HYV was lower than that of local (Table 4). The same must have also been true in Birbhum because of the substantial increase in expenditure at which a relatively small increment in the yield of HYV was obtained. Against this, in the remaining three samples (Thanjavur, Sharanpur and West Godavari) the cultivation of HYV seems to have been more profitable than local.

To recapituate, in 7 out of 16 samples the cultivation HYVs was more profitable than local varieties. In these samples the following HYVs were grown: ADT 27 in two, TN 1 in two and IR 8 in three. In the remaining 9 samples the cultivation of HYVs was less profitable than local varieties. The HYVs grown in these samples were Tainan 3 in one, TN 1 in six and IR 8 in three.[4] To view it differently, TN 1 was more profitable than local in two out of the eight samples and IR 8 in three out of six samples. ADT 27 was more profitable in both the samples while Tainan 3 was less profitable than local in the single sample where it was grown. While prices realised by cultivators for HYVs were lower than those for local varieties, the main reason behind the lower profitability of HYV in seven out of nine samples was the small increment in its yield at a substantial increase in the expenditure. Only in the remaining two samples the lower price HYV was the main reason behind its lower profitability.

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[3] In general the prices of HYV were lower than those of local because of one or more of the following reasons: (a) consumer preference in favour of local varieties, (b) poor milling quality of HYV, and (c) marketing of HYV soon after the harvest when the prices were relatively low. In some cases (e.g., Amritsar) the difference between the prices of the two varieties was very wide. This was mainly due to the local being a superior fine variety.

[4] The number of samples adds to 10 because in one sample (Birbhum) both TN 1 and IR 8 were grown.

Conclusions

The above analysis explains, perhaps more than anything else, why the spread of HYVs of rice in India has been relatively slow. It also raises some doubts about the economic viability of replacing local varieties by HYVs in many situations.

There are three qualifications to the above statement on the economic viability of replacing local by HYVs. First, the findings refer to the experience of the cultivators in the initial years of a highly complex innovation. It is not unlikely that lack of familiarity with the management problems of the HYVs came in the way of many cultivators to realise fully the potential yield of these varieties. Second, nearly half of the information analysed here refer to TN 1, a variety which was subsequently found not suitable for cultivation in many parts of India. Third, all findings refer to the kharif season. It has been consistently observed that almost all currently available HYVs perform better in rabi than in the kharif season (9, 10).

Valid though the above qualifications are, they should not be over-emphasised. A continuous cross-section survey conducted in the West Godavari District by the Indian Institute of Management, during the last three years revealed that the average yield of HYVs (mainly IR 8) was around 20 to 22 quintals per acre--only about 50 percent higher than that of local variety.[5] It also indicated that there is an increasing reluctance among the cultivators to grow HYVs in the kharif season. Though acreage under HYVs was growing rapidly in the rabi season, one cannot over-estimate its importance because most of the rice acreage in the country is in the kharif season. In another continuous cross-section survey carried out by the Institute in the delta region of Krishna canal of Andhra Pradesh it was observed that in spite of the assured irrigation, the spread of HYVs was negligible even in the rabi season. A few cultivators tried almost all currently available HYVs but gave them up in the subsequent years. The main reason behind this seemed to be an average yield of about 13 to 15 quintals per acre of an improved local variety which is preferred for domestic consumption and which fetches a higher price than HYVs.

The purpose of the above discussion is not to argue that the strategy to increase rice production in India through HYVs is a step in the wrong direction but to focus attention on the complexity of the task for a breakthrough in rice production and the nature of efforts needed for this task.

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[5] A quintal = 100 kilograms

There is an urgent need to develop HYVs suitable for cultivation in different parts of India in the kharif season because of its vastly greater importance than rabi in the total rice acreage. The potential high yield of the new varieties will have to be substantially higher than that of the competing local variety grown under similar superior physical conditions.

Because at present the acreage on which HYVs can profitably replace local varieties seems limited, simultaneously with promoting HYVs, there should be vigorous efforts in two other directions to accelerate growth in rice production: (1) increasing fertiliser use on the local varieties, and (2) improving the water availability situation in the major rice producing areas. Despite lower response of local varieties to fertiliser use as compared to HYVs, efforts to increase fertiliser use on local varieties are likely to have a large pay off in the short run because there is negligible fertiliser use on 40 to 50 percent of the total rice acreage. Research currently undertaken by the present author indicates this. To promote fertiliser use in these regions what is required is not only the creation of distribution network, which is at present concentrated in only about 100 of the 330 districts in the country, but also popularising fertiliser use on rainfed conditions and the use of lime with fertiliser on acidic soils. Since there are upper limits to growth in production through fertiliser use on local varieties because of their low production functions, it is also necessary to enlarge the acreage on which local varieties can be replaced profitably by HYVs. This requires not only the creation of additional irrigation facilities but also development of drainage facilities in much of the existing irrigated rice land.

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Rice in Thailand

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INTRODUCTION

Thailand has been a rice exporter since 1855 when the Bowring Treaty with Great Britain opened Thailand up to international trade on a significant scale. (2, p. 128). By the early 1930's, Thailand was exporting one-half of its annual production. Although World War II greatly disrupted rice production and trade in the region in general, by 1949 Thai rice exports had come back up to 1.2 million metric tons of milled rice, or 27 percent of annual production. Exports reached a peak in 1965, when 1.9 million tons, or 30 percent of total production, were exported. (2, p. 129). Exports since then have declined to about 1 million tons per year, or 10 to 12 percent of production. Although rice exports accounted for 35 percent of total export earnings in the early 1960's, the proportion declined to 20 percent in 1969. One part of the decline is due to population increase of 3.2 percent per year, with per capita consumption of roughly 155 kg per year of milled rice. (4, p. 108-110).

Although rice dominates agricultural production in Thailand, the proportion of rice in planted area of all crops declined from 88 percent in 1950 to 65 percent in 1967. Area planted to rice increased during those 17 years from 5,540,000 to 6,410,000 hectares, but area planted to all other crops increased from 752,000 hectares to 3,475,000 hectares. Rice production during that period increased from 6.8 million tons to 9.6 million tons of paddy. (5, p. 46-47).

There has been considerable discussion over whether the expansion of rice output has been due only to expansion of area harvested or whether there has also been an increase in yield per hectare. (7), (8, p. 56-71). The low quality of the data available prevents a definitive answer. It appears that yield per hectare in the mid-1960's was roughly the same as during the period 1900-1930. Yields declined steadily from the earlier period to 1954 when they reached a low of 1.25 tons per hectare. They have since climbed back to about 1.7 tons per hectare. Yields in tons per hectare vary a great deal among regions, with 2.9 in the North; 1.0 in the Northeast; 1.7 in the Central Plains; and 1.3 in the South in 1967/68. These regions accounted for 7, 35, 49, and 9 percent, respectively, of planted area in that year.

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RICE EXPORTING AND THE RICE PREMIUM

The whole rice economy, and because of its dominance, therefore the agricultural sector of Thailand, has been profoundly influenced by events immediately following World War II. The history of these events and their economic effects have been documented by Silcock, so only a brief summary will be presented here. (8, appendix I).

Because of circumstances regarding Thailand's status during World War II, Thailand was required to provide the United Nations with 1.5 million tons of milled rice at a price considerably below world levels at that time. A Rice Bureau was set up and made the only legal exporter of rice. To avoid heavy treasury costs, domestic prices of rice were kept very low. By the end of 1949, the U.N. allocation of rice ended, but the system was maintained because a rise in domestic prices to world levels at that time would have greatly reduced real incomes of urban consumers to politically intolerable levels. (8, p.217). The high world prices during the Korean conflict enabled the government to obtain considerable money by buying at the low domestic rice and exporting at world price. However, a spurt in world production resulted in a buyer's market for rice from 1954 onwards and the Rice Bureau had difficulty in exporting, and private exports were allowed to export, but were required to pay a premium for the privilege. The rate of that premium was roughly set at the difference between world market price and Thai domestic price. At the beginning of 1955, the government turned all of the rice trade back to the private sector. The "rice premium" was retained as the mechanism for keeping domestic price at the desired level below the world price. It is therefore essentially an export tax. (3).

The level of the rice premium is set by the government as a fixed amount per ton of milled rice loaded aboard ship, and the level varies for different grades of rice. The exporter procures his rice in the domestic market and makes his own sales negotiations abroad. When the rice is loaded aboard ship and certified by customs inspectors, the exporter then pays the premium to the government.

The level of the premium is supposedly flexible to take into account changes in world price levels. In practice, it rarely changes more than once or twice per year, and in fact, remained constant from May, 1963 to January, 1967. (See Table 1). In addition, changes in amount were very small during the period 1956-1966. In 1967 the procedure was changed from a specific rate to an ad valorem rate.

For example, white rice 100% is considered as the top quality Thai rice. At the peak in world rice prices in October, 1967, it sold for US$250 per metric ton, F.O.B. Bangkok. The rice premium on white rice 100% at that time was US$82 per ton. During the week ending April 5, 1971, for the same grade, F.O.B. price was US$120 per ton, and the premium was US$38 per ton. Numerous statistical studies have shown that domestic wholesale prices usually are very nearly equal to F.O.B. prices less the rice premium and exporting costs. (1). There is an additional export tax on rice, a 5.7 percent ad valorem tax which is collected on all agricultural exports.

The Thai Government also exports rice on a G-G basis. The government negotiates the terms with the foreign government, and then calls for bids from the private sector to provide the agreed upon quantity and quality aboard ship. The difference between cost of procurement to the government and what it sells the rice for is also called "rice premium", and is paid to the treasury. Since 1963, the proportion of rice exported under G-G fluctuated from 25 to 50 percent of total exports.

The export markets for Thai rice have remained moderately stable over time. Data from 1957 to 1969 are shown in Table 2. The share going to Southeast Asia ranged from a high of 73 percent in 1961 to a low of 47 percent in 1965 and 1968. West Asia's share has grown from none to 25 percent in 1968. The Middle East has also increased its production.

Over the years, the rice premium has been discussed, researched, and debated more than any other economic topic in Thailand. The proponents claim 7 benefits to Thailand. They are:

1. Major source of government revenue.
2. Only effective method of taxing agriculture.
3. Promotes agricultural diversification by making the returns from other crops more attractive relative to rice.
4. Maintains domestic food price stability.
5. Aids low income groups by keeping prices of rice low.
6. Promotes industrialization by keeping cost of living and thereby labor costs low.
7. Provides bargaining power in exporting.

The opponents have refuted, sometimes empirically, all 7 arguments. It would appear however that world market forces, and not the debate, will cause the termination of the rice premium in the near future. Present domestic prices for paddy are lower now than at any time since 1946, and farm prices of paddy are lower than the farmers can bear at the present time. The premium has been abolished on glutinous rice, but F.O.B. export prices still have fallen to $61.20

per ton of white glutinous rice, 10% long grain. Farm prices for glutinous paddy are reported to be as low as $25 per ton, and some is being used as livestock feed. The comparable farm price for corn is $50 per metric ton.

PRESENT POLICIES

Because of the dominance of rice in the Thai economy, nearly all government policies either affect or are affected by rice. However, only five policy areas will be discussed in this paper: technology, irrigation, fertilizer, domestic processing and marketing, and exporting.

Thailand has invested in rice research for a considerable period of time. Rice is the only crop to have a separate department in the Ministry of Agriculture. A breeding program was started in the early 1950's. The principle technique was to collect large numbers of selections from farmers' fields, test them under low fertility conditions (resembling farmers' conditions), and then release the best back into the local area from which they came. Many local varieties of traditional types are present in Thailand. Thai people are very discriminating in their taste for rice, and Thailand has long had a reputation in export markets for high quality rice, so emphasis in the breeding was logically on grain quality.

Thailand strongly supported the formation and early programs of IRRI and has participated in nearly all of IRRI activities. Thailand however refused to permit the introduction and release of IR-8 in the Kingdom, solely because of the quality. IR-8 was extensively tested in Thailand, and although yields were high, it was felt that the cost of damaging the export market quality reputation was greater than the benefits of higher yield. However, a crossing program using IR-8 as one parent was initiated, and two new varieties, RD-1 and RD-3, have been released. These varieties appear to be roughly equal to IR-8 in yielding ability, slightly better in disease resistance and local adaptability, and although IR-8 is one parent, the grain quality is high, following the other Thai parent.

About one million of the 6.4 million hectares of rice in the Kingdom are produced in the Chao Phya Delta. A considerable portion (perhaps one-third) of this area is subjected to deep flooding every year, and floating rice is the only crop that can be grown. This presents serious problems in water control and rice breeding.

Irrigation has received heavy emphasis by the Thai government for a long time. Some of the structures in the Chao Phya Delta date back to 1924. The biggest push started in 1950. The main policy has been to construct large multi-purpose dams and reservoirs and the main canals and laterals. The farmer has been responsible for constructing farm ditches. In general, the farmer has not done so, and consequently very little of the area under the command of major dams has good water control. This is mainly due to incomplete and poorly designed systems, rather than lack of interest on the part of the farmer. Part of the difficulty also lies in the multiple purposes for which the dams were built. Electric power generation, navigation, and salt water extrusion seem to have higher priorities than irrigation. In some cases where there is water in the canal during the dry season, but not enough to permit gravity irrigation, farmers have purchased small pumps and pump the water from the canal onto the fields. In other cases, farm cooperatives have purchased large pumps to pump out of the river. Dry season cropping however probably still covers less than 10 percent of the arable area in the delta. Although charges for water are permitted by law, in practice none have ever been made in large projects.

The situation varies in other parts of the Kingdom. Very little upland rice is grown, chiefly in mountainous areas by hill tribes under shifting cultivation. In the far north, where farm size is small (1 hectare), the farmers have developed their own year-round irrigation system. In the Northeast, dams are being built on the larger rivers. Tanks are being built on smaller streams to collect water in the wet season, chiefly for human consumption in the dry season. Nowhere in the Kingdom is groundwater being utilized through tubewells for irrigation, except in a few isolated spots. There has recently been a major shift in government policy, away from massive investment in large projects to investment in better utilization of water from the projects already construction.

Whereas because of the rice premium the farmer receives considerably less than world price for his rice, because of fertilizer policy he pays considerably more than the world price for fertilizer, and consequently doesn't use very much. There is currently an embargo on importation of ammonium sulfate and urea. The reason is that an investment has been made in an obsolete lignite conversion based fertilizer factory. Because the process is inefficient, cost of production is from 1.5 to 2.0 times the cost in the most efficient modern plant. When free imports were permitted, the plant could not sell anything that it produced. Since finance was by a foreign loan, the government is hesitant to write the plant off as a bad investment. Although fertilizer imports increased exponentially in the early 1960's, by 1969 growth in imports had stopped, and fertilizer use may have actually declined. (11). One major international firm, which had already made a sizable investment in fertilizer market development, closed its agro-chemicals division. Although parts of the rice area, particularly where phosphorus is deficient, use small amounts of fertilizer, the bulk is applied to vegetable crops.

The government has generally followed a policy of letting all processing and domestic marketing to the private sector. An attempt was made to nationalize rice milling in 1949, but met too much opposition to be implemented. The government for a time required that permission be granted for the building of new rice mills, and attempted to allocate them to different areas on the basis of production in local areas, but this requirement was finally dropped in 1968. In 1950, rice milling was concentrated in Bangkok. Decentralization has occurred until at the present time less than 5 percent of the rice is milled in Bangkok. The mills are generally scattered throughout the country and fairly well allocated on the basis of production. Most mills are of the abrasive stone type, and steam engines burning husks for fuel are a common source of power. A common milling arrangement is for the milling to be done for the bran. The farmer brings the paddy and receives all of the milled rice, with the miller keeping the bran, and sometimes the smallest brokens, as milling fee. Thus, millers frequently also have a pig feeding enterprise on the side. Most mills also have equipment to separate the rice by grade. Japanese type rubber roller mills have been tested but are not economic, because the cost of rollers is greater than added value of whole rice.

Distribution channels are very well developed and technically efficient. Most of the milled rice moves to Bangkok by river barge at low cost. When milled rice is held for more than several weeks before export, it is usually reconditioned and regraded. The grading equipment permits blending grades to specification. Retail shops commonly offer a wide range of grades to consumers.

The major export policy, the rice premium, has already been described. A system of multiple exchange rates was also in effect from 1946 to early 1955. The structure of the exporters is difficult to determine. Most have been in business a long time, and most also export other agricultural commodities. There are between 80 and 120 registered rice exporters, but it appears that most of these are exporters in name only. Exports seem to be concentrated in 20 to 25 major firms, who frequently invite other smaller firms to join in on a particular contract. This is apparently a device to make the number of firms appear to be large, so that the large firms are not charged with monopoly or oligapoly power. Most sales within the region, to Hong Kong, Singapore, and Malaysia, in particular, are based on personal or family contacts with orders placed by telegram or long distance telephone calls.

One of the most striking features of the Thai rice trade is the very fine and carefully controlled system of 38 grades. This system of grades was developed by the private traders themselves, and adherence to system is also maintained by the traders, not the government. Most traders belong to one of the national chambers of commerce (Thai, Chinese, etc.), to the Thai Rice Trade Association, and to the Board of Trade of Thailand, although membership is not compulsory.

FUTURE ISSUES

There has been a great deal of discussion in Thailand during April, 1971, about the rice problem. Unfortunately, much of the discussion is based upon opinion and very little is based upon facts. The purpose of this paper is to present some facts and the conclusions that can be drawn from them, and to point out areas in which more facts are needed before the problems can be solved.

First, although rice is still a very important part of the Thai economy, very little is known about the quantities produced, marketed, consumed, and carried over from year to year. Export data, except for that smuggled out of the country, are known; production is roughly estimated by both an obsolete village headman reporting system and a sample survey with an error too large to be tolerated; and everything else, including stocks on hand, is "questimated". It is impossible for an exporting country to operate in today's highly competitive buyers' rice market with such faulty information. A modern and accurate rice data program is long overdue. A statistical crop reporting service, vested with the sole responsibility and authority for all rice data should immediately be established in the Ministry of Agriculture. Budget and personnel now engaged in rice data collection of some type or other and spread out over at least 7 different departments, divisions, sections or offices should be transferred to the new service. Full access wherever needed to the NSO computor should be included. The technology and the expertise are available, they simply need to be utilized in one central program.

Second, the internal conflict between the policy of keeping domest'c prices low and the policy of improving farm income must be resolved. At the present time the farm floor support price program and the rice premium are in direct conflict. Trying to push prices down via the rice premium and pull them up via price supports is akin to a man standing in a basket and trying to lift himself off of the ground. With great exertion he can jump and actually raise the basket off of the ground, but when he lands he is likely to break both the basket and his feet.

The stated procedure of stabilizing domestic prices by manipulation of the premium rate has not been followed. When F.O.B. prices were $250 per ton (100% grade 2) the premium was $82 per ton. When F.O.B. prices fell to $120 per ton, the premium was only reduced to $38 per ton. Its effectiveness as a bargaining tool in exporting has not only been lost, but it in fact has hurt exporting, because of frequent rumors and statements in the press, and indecisiveness about changing the level of the premium. While the premium does keep consumer prices low, it no longer is an important source of government revenue, it no longer affects diversification, and it is an oppresive taxation of agriculture.

It has recently been suggested that the premium be abolished for lower quality grades of rice but kept for the highest quality grades, namely 100% and 5% white rice. Such a move would be self-defeating for several reasons. One is that Thailand's export reputation is built upon high quality grades. Thai white rice 100% is available nowhere else in the world but in Thailand. But retaining the premium on 100% and abolishing it on lower grades would have the effect of making 100% cheaper relative to lower grades in the domestic market. This would not only encourage increased domestic consumption of 100% relative to lower grades, thereby discouraging export of this high foreign exchange earner, but it would also serve as a disincentive to producers and millers for producing high quality rice. Another reason is that Thailand faces its stiffest competition in exports in the low quality rice, not in 100% or 5%. It is the 25% and 35% and the parboileds that compete with IR-8 and others being exported by other countries.

Given these facts and the current turmoil and uncertainty regarding Thai government manipulation of the rice premium, there is only one solution. Abolish it totally and across the board.

The immediate consequence would be an across the board rise in domestic prices by something less than the current amount of the premium. What does this mean? The current F.O.B. price for 100% grade 2 is Baht 2,400 per ton, the premium is Baht 750 per ton, and the Bangkok wholesale price is Baht 1,530 per ton (week ending 5 April, 1971, as certified by the Rice Committee of the Board of Trade of Thailand). In other words, wholesale price plus premium is Baht 2,280 per ton, leaving Baht 120 to cover cost of exporting, including other taxes, and profit. The wholesale price would rise to something less than Baht 2,280 per ton (perhaps Baht 2,200). Assuming a marketing margin (spread between what farmer receives and wholesaler receives of 19%), (6, p. 248), this would mean a farm level price of Baht 1,782 per ton of 100% milled rice or Baht 1,157 per ton of the equivalent amount of paddy (1.54 tons) required to obtain 1 ton of milled rice (65% commission rate). Although this is less than the desired price support of Baht 1,300 per ton for Special No. 1 paddy, it is close to the goal of Baht 1,150 per ton of Special No. 3 paddy. It is recognized that not all paddy produced will yield 100% milled rice, but somewhere between one-fourth and one-half would , depending upon weather conditions during ripening and harvest, and incentive to millers. The increased domestic price of milled rice would raise the cost of living in Bangkok by 3 percent or less.

A rice price support program (floor prices to farmers) is technically, economically, and administratively unfeasible on several counts. A farm price above domestic equilibrium price is not feasible unless production controls are also put into effect. Limiting the amount of rice each and every rice farmer in Thailand can produce is not feasible. A price support program requires storage space for the rice purchased or, in some cases, the rice against which loans or advances are made. Storage space of a volume sufficient to make the scheme work is not available.

Price supports are not economically feasible for several reasons. How much rice would have to be purchased by the government to raise price to all farmers? If 10 percent of the quantity produced, it would require 1.3 billion baht. The answer is probably nearer 30 percent or 4 billion baht, or 20 percent of total government expenditure in 1969. Such magnitudes might have unmanageable repercussions on monetary and fiscal problems. If 80 percent of the people are farmers, then can the remaining 20 percent be taxed (probably only 5 to 10 percent are taxable) to operate a rice price support program?

The rice price support program is not administratively feasible at the present time when it handles only 0.5 percent of production. Already it is diverting scarce talent in the government from other pressing problems. A program of the magnitude that could affect farm income is totally unfeasible administratively.

In one sense, Thailand is fortunate to have had the rice premium in the past, strictly in the sense that domestic equilibrium prices are now below world equilibrium levels, even though world prices are at low levels. This means that there are feasible government policies that can affect farm income in the short run, namely abolishing the rice premium and allowing farm prices rise to world levels.

Third, is the management of exports in the short run. Totally abolishing the premium will make exporting freer. There should be no restrictions on exporters, with the objective of maximizing foreign exchange earnings. This means exploiting all natural and comparative advantages, and it also means G-G sales where necessary, and for credit if necessary. The possibilities of some barter with countries such as India, Ceylon, Philippines, etc. should be explored for products now imported, such as steel, railway cars, fertilizers, etc. There also should not be any government effort to maintain a large number of exporters, ostensibly in the name of competition. In fact, a smaller number of large firms, each with large volumes, should be encouraged. With a small number of large firms, both the supervision to maintain grades and standards and fulfillment of contracts would be easier, and the penalty for violation would be more severe. The goal should be no more than 10 exporting firms, each with a volume of at least 100,000 tons per year.

Fourth, a very keep look must now be taken at Thailand's rice prospects over the next 5, 10, and 20 years. In doing so, the facts are fewer and the informed best judgments and research backed speculations must be more. With respect to production, what natural, absolute and comparative advantages does Thailand have with respect to the rest of the world? Vast areas of the central plains are suited for nothing else but rice production. In some of these areas, Thailand probably has an absolute cost advantage over the rest of the world. In other parts of the Kingdom, there are bast areas currently in rice production that might be better suited to some other crop production if highly productive new varieties of these crops were developed. One basic fact cannot be ignored. Productivity throughout Thai agriculture is very, very low. Thailand has not participated at all in the so-called "green revolution". There cannot be any long run increase in farmers' income until productivity is raised. The past 20 years of gaining increased production through exploitation of new land is at an end. The task is now to increase productivity on the land now under cultiva-

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tion. And this can come about only through well organized, adequately financed, and problem oriented research programs focused on the crops with the greatest potential. (10). The consequences of a failure to do so are severe. If Thailand doesn't improve productivity, it will not need to worry about exporting rice, for in 10 years it will be a rice importer. (9).

Another fact is currently being ignored in the public debate on the rice problem. One must distinguish between two different causes of reduced exports, namely between demand constraints and supply constraints. F.O.B. export prices in October, 1967, were the highest in Thai history. Yet exports in 1967, 68 and 69 were 1.48, 1.03, and 1.02 million tons, respectively. Exports for 1964, 65 and 66 were 1.9, 1.9, and 1.51 million tons, respectively. Bad weather, excessive carry-over stocks, smuggling, and other causes have all been blamed. But the real reason is probably that population is increasing faster each year than is production. The conclusion is that Thai rice faced a supply constraint before it faced a demand constraint. The current emphasis on policy measures to combat a demand constraint are diverting attention from the supply constraint.

Resolving the supply constraint involves a number of policies that have been discussed elsewhere. Briefly they include water control, research on new varieties, and a rational fertilizer policy. (11).

The question is, should Thailand increase rice production? It has no choice, unless it wants to become a rice importer. The real question is strategy. All production must come from a land area of probably no more than one-half of the current area planted to rice. Which means something on the order of doubled yields on the land best suited to rice or without an alternative use than rice. Diversification as presently being expounded is an empty phrase. Land cannot and will not be diverted from rice to other crops unless rice yields or other crop yields or both increase substantially. Slogans don't diversify production, but good research and rapid adoption of its results could.

There are other questions involved as to what long-run level of rice production should be sought. One question is whether the current world situation is the result of a permanent increase in the trend of world rice production, or whether it is just a temporary shift in the level of the old trend. Will production continue to increase faster than population, or will the countries now climbing towars self-sufficiency be massive importers again in 5 or 10 years?

What will be the nature of the Thai domestic demand in 10 or 20 years? The number of Thai people will double in the next 17 years, and if the present level of consumption remains at 155 kg. per capita, massive increases in production will be necessary for Thailand to remain self sufficient. The alternative is a large shift in tastes and preferences from rice to wheat. Income elasticity of demand for rice in Thailand is still positive, although low, and wheat cannot be produced in commercial quantities, so a shift to wheat doesn't seem likely. Thailand has got to be a major rice producer for a long time.

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Table 1. Premium Rate on White Rice 100% Exported from Thailand, December 1955 to April 1971.

Period	Baht per Metric Ton
12/55 - 12/56	935
1/57 - 6/57	840
7/57 - 7/59	935
8/59 - 8/59	750
9/59 - 12/59	935
1/60 - 3/63	890
4/63 - 12/66	950
1/67 - 2/67	1,010
3/67	1,090
4/67	1,240
5/67	1,300
6/67	1,320
7/67	1,470
8/67	1,640
9/67	1,520
10/67 - 2/68	1,640
3/68	2,070
4/68 - 5/68	1,960
6/68 - 10/68	1,830
11/68 - 5/69	1,450
6/69 - 11/69	1,100
12/69 - 10/70	1,000
11/70 - present	750

Source : Department of Foreign Trade, Ministry of Economic Affairs

Table 2. Thai Rice Exports by Country of Destination, Per cent of Total Quantity Exported Each Year.

Year Country	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
Southeast Asia													
Hong Kong	12.3	15.1	14.9	14.9	12.4	17.2	13.5	10.8	10.8	14.2	14.5	12.3	16.9
Malaysia	14.3	17.0	24.4	19.9	15.7	15.6	17.7	15.4	14.3	10.2	13.7	17.8	14.7
Singapore	17.2	19.6	20.0	17.4	12.3	13.5	12.4	12.1	9.1	9.5	8.1	12.3	13.1
Indonesia	11.4	11.6	6.8	11.4	23.8	21.0	23.9	23.8	5.7	11.1	12.0	4.2	7.9
Philippines	6.6	4.1	0.04	0	8.9	0.03	5.1	5.7	6.8	3.2	6.7	0	0
	61.8	67.4	66.14	63.6	73.1	67.3	72.6	67.8	46.7	48.2	55.0	46.6	52.6
East Asia													
Japan	9.3	6.4	8.5	7.5	3.2	5.0	7.5	6.7	8.1	6.1	9.3	9.3	6.2
Taiwan	0	-	0.4	1.6	4.8	0	0.1	1.2	0	0.1	0.4	0.01	0.7
	9.3	6.4	8.9	9.1	8.0	5.0	7.6	7.9	8.1	6.2	9.7	9.3	6.9
West Asia													
India	0.2	0.02	0.01	0.01	0	0.01	0	1.8	11.3	12.1	12.4	19.5	11.2
Ceylon	2.9	0.02	-	0.7	3.9	3.5	2.5	1.6	9.8	7.4	6.5	5.4	3.0
	3.1	0.04	0.01	0.7	3.9	3.5	2.5	3.4	21.1	19.5	18.9	24.9	14.2
Middle East	5.4	5.9	10.9	9.3	4.6	7.4	6.6	5.5	5.2	4.7	5.5	7.8	7.6
Europe	4.9	7.8	5.0	2.8	2.9	4.4	1.5	2.8	2.0	2.2	0.5	0.4	1.0
Other	15.5	12.4	9.0	14.4	7.4	12.3	9.1	12.5	16.8	19.1	10.4	11.0	17.6
Total	100	100	100	100	100	100	100	100	100	100	100	100	100

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Rice Policy in Ceylon

T. Jogaratnam

I

Agricultural policy in Ceylon emphasizes the attainment of self-sufficiency in rice production. This is understandable in the context of the preference for rice in the diet of the people, the importance of rice in the peasant sector of the economy, and the large scale dependence on imports to meet the rice requirements of the country. While government policy has mainly concentrated on the extension of the area under cultivation, several other measures have also been introduced. An attempt is made in this paper to describe current rice policy and to discuss some of their implications. This, however, is preceded by an account of the main highlights of the agricultural economy, with special reference to rice.

Rice in the Economy

The modernization of the Ceylon economy is associated with the development of export crops. Coffee was the first crop to be organized on a commercial scale, around 1850. It, however, succumbed to a fungus disease but was quickly replaced by tea, rubber and coconut. Today, these crops hold a predominant position in the economy, occupying about 60 percent of the cultivated area, contributing about a third of the gross national production and providing direct employment to about 30 percent of the total gainfully occupied population. Even more significant is that these three products account for about 90 - 95 percent of the total export earnings of the country and thus help finance the import of a considerable proportion of Ceylon's requirements of food. Imports of food items have in recent years accounted for nearly 50 percent of the country's export earnings and for about 45 percent of the total import bill.

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A wide variety of food items are imported into the Island, but imports of rice bulk particularly large. Given the difficulties in expanding export earnings, development policy has emphasised self sufficiency, specially with regard to rice production. The importance attached to rice production also stems in part from the fact that it is the preferred food of the people. It accounts for 50 and 45 percent of the total calorie and protein supply respectively. It is also the single most important crop, accounting for 32 percent of the total area under crops and for 49 percent of all agricultural holdings. It is essentially a small-holder crop with 75 percent of all holdings under paddy being under 5 acres in extent.

In discussing rice policy, one should also take into consideration the influence of climatic factors on rice production. The country is conveniently divided into the Wet and Dry zones, with the Wet zone occupying the south west quadrant including the central highlands. While it accounts for one-third of the land area, it supports about 75 percent of the population. It receives an evenly distributed rainfall of 100 - 150 inches per annum, increasing to over 200 inches in the central highlands. The high rainfall associated with the steep slopes of the hill country make the wet zone particularly well suited to tropical tree crops and the tea and rubber and much of the coconuts are confined to this area. Rice occupies the valley bottoms and coastal plains. Much of the land is under cultivation, with undeveloped land being estimated at 15 percent.

The remaining three-quarters of the Island receives a mean annual rainfall of from 50 - 75 inches. Most of it is deposited during three months of the year and there is a long dry season of about six months in which evaporation is high. This has given rise to the term Dry zone for this area. Much of the Dry zone is uncultivated except for areas where irrigation is possible. Over 60 percent of the area is under jungle. The Dry zone was however the seat of ancient civilisations based on an intricate system of tank irrigation. Much of present day policy has been directed towards the restoration of these ancient tanks.

Requirements of Rice.

The major problem in determining future requirements of rice is to establish the relative levels of consumption of rice and wheat flour. It is assumed that the goal of self-sufficiency in rice would be to meet the total demand for rice from domestic production and to reduce, if not replace, the wheat flour component of cereal consumption which is entirely imported. Wheat flour consumption in the post war period has varied, depending on the availability and price of rice. Consumption of wheat flour reached its lowest, and of rice its highest, level in 1960 - 64 when the rice ration was increased to two measures and made available at 25 cents a measure.

On the other hand, wheat consumption has increased sharply since 1967, consequent to the reduction in the rice ration and the increase in the rice support price.

Levels of per capita consumption obtaining in 1960 - 64 can be used to establish future requirements of rice and wheat flour. Gross consumption works out to 235 pounds of rice, or 8 bushels of paddy, and 40 pounds of wheat flour per head per year. These calculations are based on official statistics relating to production and imports. One may also make use of consumption data inorder to provide a cross check on the accuracy of the above estimates. The Survey of Consumer Finances carried out by the Central Bank of Ceylon in 1963 provides information on food consumption. Per capita consumption of rice is established at 16.75 measures for two months. This works out to [illegible] pounds of rice and would approximate the earlier calculations, if allowance is made for consumption outside of household not included in the survey. Since the entirety of wheat flour is imported, the estimate for wheat flour consumption could be assumed to be fairly accurate.

In establishing the above requirements, no account is taken of the income effect on consumption. Consumption data however indicate a remarkable uniformity in the amount of rice consumed throughout the entire income range, except the very highest. The consumption of bread, on the other hand, does show an increase with increasing incomes while the consumption of wheat flour shows some increase before declining.

Available data on income elasticity coefficients indicate a positive relationship but range from 0.1 to 0.5 for rice and 0.6 to 0.7 for wheat flour. Data on per capita incomes indicate that in the past incomes have increased at about 1.3 percent. To postulate a rate of increase of anything over 2.5 percent in the future could seem to be ambitious, given the high rates of population increase. To estimate the rate of increase in consumption, one needs to know the rate of change in prices as well as the price and cross elasticities of demand for rice and wheat. But in the absence of such information, it would seem safe to assume that the per capita consumption of rice is likely to remain fairly stable, as long as the price relationships between rice and wheat flour remain close to what it was in the 1960 - 64 period.

Given the level of per capita consumption, future requirements would depend on population. Ceylon has experienced high rates of population growth in the past, averaging around 2.6 percent per annum during the period 1959 - 65. In more recent years this has fallen to about 2.3 percent, due mainly to an increase in the average age at marriage. A continuation of this trend would depend on the success of the family planning programmes. Population projections for the Island are based on a low estimate of 2.0 percent and a high estimate of 2.4 percent in the growth rate of population.

Policy Programmes for Self-sufficiency

Ceylon at present produces about 75 percent of its rice requirements. It is estimated that the goal of self-sufficiency could be achieved by the second half of the seventies if the current rate of increase in production of about 4.5 percent could be stepped up to about 6.5 percent. The highest priority is accorded to this objective because it is seen as the primary means of saving foreign exchange.

Several measures have been introduced to promote an increase in rice production and it is convenient to discuss them under the headings of irrigation and land settlement, structural reforms, subsidization of inputs and research and extension.

Irrigation, Land Development and Settlement

The development and colonization of the Dry zone has received major emphasis in the past and still continues to do so. There has been in past a desire to revive some of the old glories of the Dry zone. Colonization has also been looked upon as a means of relieving population pressure in the Wet zone and increasing rice production.

While several attempts were made sporadically to restore some of the abandoned tanks, the policy of state aided land colonization dates back to 1935 when the Land Development Ordinance was passed. The government progressively accepted responsibility for providing irrigation facilities and developing the land in full, including the colonists'house, before the settlers moved in. There have been some modifications from time to time, but the basic policy has remained unchanged. The unit of allotment has varied from 5 acres of lowland and 3 acres of highland in the early years to 3 acres of lowland and 1 acre of highland in recent years. Allottees are prohibited from selling, mortgaging or leasing the land and subdivision is not permitted beyond a certain minimum size. A recent amendment relaxes the idea of a protected holding, but the authority for such relaxation is vested in the government.

The government efforts have led to a marked increase in the area under rice. Land alienated under the Land Development Ordinance during the period 1936 - 1966 is estimated at 600,000 acres and over 83,000 farmers have been settled. The Development Plan for 1966 - 71 set out a target of an additional 312,000 acres of which 60 percent would be irrigable. Plans beyond 1970 rest on two major schemes,the Uda Walawe Scheme and the Mahaweli Diversion project. The former will make available over 60,000 acres of new irrigable land over the next few years, while the latter would provide water to 627,000 acres of new land and improve water supply to another 272,000 acres over a thirty year-period. It is felt that this would more or less exhaust the possibilities of any further extensions to the area cultivated.

Structural Reforms affecting agriculture.

Attempts have also been made to remove some of the factors inhibiting the development of the agricultural sector. It has been recognised that the adoption of appropriate land, credit, marketing and price policies are essential to set up the necessary pre-conditions for agricultural development. With this objective in view, the government has in recent years introduced measures to regulate landlord tenant relationships, improve marketing and credit facilities and provide price incentives for production.

(1) Land Policy. In the sphere of land reform, the government passed the Paddy Lands Act in 1958 with a view to providing security of tenure, specifying rent and regulating interest on loans to paddy cultivators and the charges for hire of implements and buffaloes. The implementation of this act has however run into difficulties and legal processes involved in enforcing the legislation are cumbersome and time consuming. No study has been carried out to evaluate this reform, but available evidence indicate that it is inoperative for the most part. The age old tenancy relationships still continue to operate, mainly because tenants continue to depend on their landlords to fulfill a wide range of social obligations. Tenancy however is not as important in Ceylon as in some of the other less developed countries. According to the 1962 Census of agriculture, 15 percent of all cultivators cultivating land under 50 acres in extent were "full tenants" renting all their land and another 20 percent were part owners renting some land in addition to their own. Together they comprise 38 percent of all farmers cultivating 24 percent of all agricultural land under some form of rental arrangement.

(2) Credit Policy. Government policy has sought to replace the money lender and boutique keeper as the main sources of supply of credit. To this end, it has tried to sponsor co-operative credit societies. The need to integrate credit with production and marketing has been realized over time and agricultural credit is now channeled through multi-purpose co-operative societies. The quantum of credit has been increased successively and the procedures involved in getting credit have been repeatedly streamlined. There is however a serious lack of information on the extent to which farmers are dependent on institutional sources of credit. A major problem has been the poor recovery of loans. Co-operatives have never been able to exercise any supervision of lent funds and it is felt that a considerable volume of credit is channelled into non-productive purposes. Moreover, it appears that the private lender has always a prior claim on farmer's incomes. The proposed Paddy Marketing Board with a monopoly over paddy purchases may provide a possible solution.

(3) Crop Insurance A crop insurance scheme was introduced in 1958 and it is now estimated to cover 15 percent of the total area under paddy. It is an all risk, compulsory scheme and is partially subsidised by the government. The inability to collect premium dues has been the most serious setback to the scheme. A shortfall in premium collection of about 61 percent is estimated for the period 1959 - 70.

(4) Marketing and Price Policy The government also operates a guaranteed price scheme which ensures to the cultivator a stable price above world levels. While a number of commodities are covered by this scheme, it is primarily applicable to rice. The price for paddy remained at Rs.12 per bushel till 1967 when it was raised to Rs.14. During much of this period, the price of imported rice in terms of paddy fluctuated between Rs.6 and Rs.9. Because of the high level of the producer price, the government also operates a consumer subsidy. This has been in existence since the war. From 1960 to 1966, 2 measures or 4 pounds per person per week was supplied at 25 cents a measure. Ignoring processing costs, this worked out to Rs.4 per bushel of paddy. In 1967, the subsidy was changed to 2 pounds per person, free. It was again changed in 1970 to 4 pounds, the first 2 pounds being free and the second 2 pounds at 75 cents.

Co-operative societies, acting as agents for the government, purchase the paddy. But despite the high guaranteed price and the consumer subsidy, producers do not seem to be handing all of their production to the government. Because of problems of lack of storage space and delays in payments, producers often sell in the open market at prices below the guaranteed price.

Subsidization of Inputs.

The government also subsidizes the use of inputs in production. The most important of these is the subsidy on the purchase of fertilizers. Until 1969 a 50 percent subsidy was given on cash sales and a 33⅓ percent subsidy on credit sales. At present, a 50 percent subsidy is available to all. Improved seed varieties are also sold to farmers at a subsidy of Rs.2 per bushel.

Research and Extension.

One of the important goals of agricultural policy is to educate farmers in the more modern techniques of rice production. Research and extension in agriculture is in the hands of the Government Department of Agriculture. Its primary aim is to develop better methods and carry these techniques to farmers.

Research is directed towards the development of improved varieties for the different agro-climatic zones. Efforts are also underway to survey and classify rice soils, determine their fertilizer requirements, improve fertilizer practices and control pests and diseases.

Problems however arise in carrying modern technology to farmers. Lack of trained personnel is a serious problem. It is estimated that the number of village level workers will have to be increased tenfold if something like an optimum distribution is to be achieved. Even more important is to have them adequately trained. At present, they have only a year's vocational training in farming.

Some Policy Problems.

It is likely that Ceylon will reach self-sufficiency in rice production sometime during the next 10 - 15 years. In the meantime it is not too early to consider the problems farmers will be facing more and more as self-sufficiency in rice is approached.

In the short run, purchases under the guaranteed price scheme are likely to create problems. With the government hoping to become a monopoly buyer, problems of storage, transport and milling become more important. The need for adequate facilities has been realized and much depends on how soon these can be provided. It is anticipated that purchases could treble over the next few years.

The financial ability of the government to handle an increasing volume of purchases, given the high support prices, poses another problem. The level of subsidy is however tied up too much with politics for any reductions to be effected. With shifts in demand patterns associated with economic development, it is also necessary to know whether a policy of self-sufficiency in rice would effect the greatest savings in foreign exchange. Attempts are being made to increase the production of subsidiary foods like chillies and onions and animal products which are being imported in increasingly large quantities. But the high level of the rice subsidy would seem to frustrate such efforts.

It is also necessary to view self-sufficiency in the broader context of farm incomes and employment and not consider it narrowly from the point of view of production only. It is becoming increasingly clear that the drive towards self-sufficiency is not benefiting all farmers equally. The small farmers of the Wet zone with holdings of less than 2 acres and with no assured water supply produce hardly any surplus to benefit from the high support prices. Their problems will become more acute. In the longer run, an increase in incomes and employment can be brought about only by changes in the patterns of production towards more intensive farming.

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farmers will have to turn away from the narrow specialization on rice, which in the context of self-sufficiency may bring in its train problems of surpluses. With economic development and rising levels of living come a diversification in consumption patterns and farmers will have to be helped to effect changes in production patterns as well.

Self sufficiency in rice is a desirable goal. But as the country approaches self-sufficiency, there is a need to decisively shift emphasis to increasing production of other farm products including some in which the country is capable of competing in world markets and earning foreign exchange. This calls for more balanced agricultural development than one directed solely toward self-sufficiency in rice.

Food Consumption and Rice Production in Korea

Jin Hwan Park *

I. Introduction

Rice, barley and wheat are the major food grains for domestic consumers in Korea. The annual domestic consumption of the three food grains was about 8 million tons in 1969-1970; 4.5 million tons of rice, 2 million tons of barley, and 1.6 million tons of wheat. About three-fourths of the consumption of food grains is produced from domestic agricultural resources.

The agricultural land and climate in Korea are suitable for increasing production of rice and barley, but the limited land resource is unable to produce enough wheat and concentrate feeds, for which the demand is increasing rapidly in accord with the high growth rate of urbanindustrial sectors.

About 2 million hectares of cropland in Korea is used to produce food grain a little over 30 million population. About 60% of the total area of cropland is paddy land on which one rice crop is produced from June to October, and for the rest of the year most paddy land is idle due to the cold winter climate. Non-paddy lands are called uplands, on which soybeans, sweet potatoes, corn, sorghum, etc. are produced as summer crops, and barley and wheat are produced as winter crops.

Korea was not a rice importer until the late 1960's. The current annual domestic production of rice ranges from 3.5 to 4 million tons, which is not sufficient for a stable rice market in the off season. Hence, on the average, a little over one half million tons of rice has been imported in recent years, mainly from United States and Japan, and the imported rice is distributed for urban consumers in large cities to supplement the shortage of domestic rice in the off season.

In order to minimize the foreign currency needs for importing rice a high priority in policy planning has been given to increasing rice yield on the existing land area. It is expected that rice import will cease by the mid 1970's.

Barley is consumed mainly by farm families in the producing areas and by low income urban families. The government is also emphasizing increase in barley production for two reasons; it is the second most important food grain to supplement for the shortage of rice, and a supplementary use of land and labor is possible by planting barley in the winter season. Without barley production, most cropland will be idle in winter.

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Consumption of wheat flour is closely associated with the growth of the urban-industrial sector of the Korean economy, and the domestic production of wheat can meet only about one-fifth of the current consumption.
It is likely that the import demand for wheat will increase as the urban-industrial sector grows.

As livestock enterprises shift from supplementary enterprises of general crop farms into specialized commercial production, especially in poultry, broilers, hogs, and dairy farming, the import demand for concentrate feeds is increasing rapidly. Currently, corn is imported for feed, and the annual import demand will be increased from one-fourth million tons to one-half million tons in 1971-1976.

In this report the factors affecting domestic demand for food grains and the public programs for increasing rice yield in Korea will be discussed.

II. Factors Affecting Domestic Food Grain Consumption and Related Problems

Among the food grains, wheat has been the major import item for the last two decades.1/However, the import of rice has increased rapidly in recent years. Also, the import of corn for livestock production is increasing rapidly.

Table 1 shows the annual domestic production of major food grains and grain imports for the last 15 years. Until recent years, most of the domestic consumption of food grains was supplied from domestic production, except for wheat.

In 1965-1966, around 600,000 tons of grain were imported per year, of which wheat made up 500,000 tons, and the self-sufficiency rate of grains (domestic production of grains/total domestic consumption of grains) was a little over 90%. However, grain imports have increased rapidly since 1967. The imported grain in 1967 was 1.1 million tons and it increased to 2.4 million tons in 1969. The severe droughts which occurred in 1967 and 1968 were the cause for the rapid increase of grain imports, resulting in the self-sufficiency rate of grain declining from 85% in 1967 to nearly 70% in 1969.

The composition of imported grains in 1969 was about 750,000 tons of rice, 1.4 million tons of wheat, and 170,000 tons of corn for feed, totaling 2.4 million tons. An important part of the imported grains in these years was purchased under long-term loans and some under food-aid programs. Thus foreign currency will not be paid in the immediate future, and the local currency received by the government is being utilized for various development programs and for fund raising for the rice price support program. However, if the tendency to increase grain imports continues as in recent years, the accumulation of foreign exchange requirements will become an important factor for postponing the economic self-sufficiency of the Korean economy.

A core question or food problems in Korea is to what extent the domestic agricultural resources can supply food grains to meet the increasing demand. The climatic conditions in Korea are favorable for rice production and a significant increase of rice production is urgently needed to minimize the import demand for rice in the Third Five-Year Plan (1972-1976). Also, encouraging barley production will play an important role in alleviating the shortage of rice during the Third Five-Year Plan period.

Because of the climatic conditions required for expanding wheat production, the import demand for wheat will increase continuously as urban-industrial growth continues. 2/ As will be noted later there is an indication of excess import of wheat in recent years. Hence, an objective judgement for an adequate import demand for wheat in the 1970's is needed to minimize the foreign exchange requirements. Also, policy measures for effective use of wheat flour by domestic consumers are required.3/

The import demand for corn and other concentrate feeds will increase rapidly in the 1970's, depending upon the growth rates of urban-industrial activities. The production potential for feed grains by domestic agricultural resources is inadequate to meet the increasing demand for concentrate feeds.

Thus, among grain crops special attention will be needed for rice, barley, wheat, and corn.

The past trend in per capita consumption of an individual food item provides a base for the projection of food demand. Table 2 shows the per capita consumption of major food grains during the period 1957-1969. For comparison, the consumption level of Japan is shown for the same period.

Let us consider the per capita consumption of rice, which is the most important food item in Korea. For the last 15 years the per capita consumtion level of rice ranged from 125-130kg with a slight increasing tendency.4/

The per capita real income during the period increased by about 80%. As is shown in Table 3 the relative price of rice to other grains has not changed significantly, although the price of protein foods has increased more than the price of starchy foods in recent years. Considering these factors the fact that per capita consumption of rice remained at the level of 125-130kg implies that the income elasticity of demand for

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rice is not of a high positive value. Taking the following four variables into account the per capita consumption of rice, the per capita real income, the relative price of rice to barley, and the relative price of rice to wheat in the period 1957-1969 an income elasticity of rice was measured by logarithmic function as shown in Table 4. The income elasticities measured from the time series data turned out close to zero. A number of previous studies on the income elasticity of rice measured from cross section data found relatively high positive values in a wide range around 0.4. 5/

Many factors have contributed to the disagreement in the coefficients between time series and cross section data. If the elasticity measured from cross section data is correct, that is, if 0.4 is an unbiased estimate, the per capita consumption of rice would have increased from 125kg to 175kg in the period 1957-1969, for the per capita real income increased by 80%, without significant changes in the relative prices of rice to other grains. However, the official statistics on rice consumption were in the range of 125-130kg for the last 15 years. On the other hand, the elasticity measured from time series data in Table 4 must be questioned on the reliability of statistics for rice production and population in the period of 1957-1969.

In the author's opinion, however, the true value of income elasticity for rice seems not to be high, and the coefficients measured from the time series data in Table 4 seem close to reality. The cessation of rice exports to Japan after the liberation of the country in 1945 increased the availability of rice for domestic consumption in the post-1945 period.6/ Also, the land redistribution programs which were undertaken in 1945-1955 were a factor causing increased consumption of rice by farm families because tenants were no longer required to pay rice as rent. Thus, even though the per capita real income remained the same in the post-1945 period, the consumption level of rice increased to the present level due to the increased availability of rice for domestic consumption.

Presently, it appears that the per capita consumption of rice for medium and upper-income urban families has nearly reached the saturation point, and a further increase in real income in these income classes may reduce the consumption level. The amount of rice consumed by urban families has become smaller in recent years, as reflected by a smaller size of rice bowl. The per capita consumption of rice by low income urban families will increase as their income increases. Presently, barley is the main item supplementing the shortage of rice for low income urban families. Taking urban families as a whole, the income effects on rice consumption seem to be low. The rapid increase in real prices of livestock products and marine foods compared to cereal prices in recent years (see Table 3) seems to be a strong factor retarding the reduction of rice consumption among urban families.

For farm families, however, the income effects on rice consumption will be significantly higher than that for urban families, although the consumption level of rice on tenant farms increased after the land redistribution program. The per capita consumption of rice especially for families on small size farms or for subsistence farmers in upland farming areas will increase substantially when their real income increases. Barley, potatoes, corn, and other grains are being used as supplements to rice for these poor farm families.

From these observations we can say that the growth in population will be the most important determining factor for the future demand for rice in Korea. One could predict that the aggregate demand for rice in the 1970's in Korea will increase a little faster than the growth rate of population. If the population grows by 2.5% or less per year the demand for rice will be increased by around 3% per year, on the average. Then rice self-sufficiency would be achieved if on the average the domestic production could be increased by 3% or more per year during the period. The feasibility of this rate of increase is a challenging question.

The annual domestic production of rice in 1956-1969 is shown in the first column of Table 5. The large variation in the total production from year to year is impressive. For example, the total production of rice in 1963 rice year was 3 million tons, but it was 3.9 million tons in 1965. The total production was reduced again to 3.2 million tons in 1969. With such large variations, the average annual growth rate of rice production has limited usefulness as an indicator of the feasibility of self-sufficiency in rice.

In fact, the instability of the domestic supply of rice creates the major problem related to rice in Korea. We have already seen that the demand for rice is fairly stable, for the per capita consumption has remained in the range of 125-130 kg for the 1st 15 years. Hence, an excess supply of rice or critical shortage of rice at the market was mainly due to the large fluctuation in rice production. Random effects of weather variables, especially the rainfall in the growing season for rice, are the major causes for the large fluctuations.

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To analyze the yearly variation of rice production for the period 1957-1969 linear regression equation was fitted to the actual production of rice for the period 7/ From the equation the fitted value of rice production in a given year, which is the expected average production, was obtained, then, the actual production was divided by the fitted value to get the deviation of actual production from the expected production in terms of percentages. The results are shown in the second and third columns of Table 5. In the 1957 rice year, for example, the actual production was 16% less than the expected production. Also, in the 1969 rice year the actual production was 15% less than the expected production. The severe drought in the summer of 1968 was the main cause for the reduced production of 1969 rice year (November 1968 to October 1969). On the other hand, rice production in 1965 rice year was 13.8% more than the expected production for that year. The ample rainfall in the summer of 1964 was the major cause for the high production.

By a similar method, the yearly variation of rice production in Japan was analyzed for the same period (see Table 5). Here, we note that the annual fluctuation of rice production in Japan is significantly less than that in Korea. The difference in rainfall and in irrigation facilities are major contributing factors to the difference in rice production between the two countries. The annual precipitation in Japan is about 25% larger than that of Korea, and the rainfall during the growing season is more evenly distributed in Japan. In addition to the more favorable rainfall distribution, the irrigation facilities for paddy farming in Japan are far more improved than in Korea. About 90% of total paddy land in Japan is safely irrigated, compared to a little over 70% in Korea.

In the financial investments for the agricultural sector in the First and Second Five-Year plans the government put a high priority on the improvement of irrigation facilities for rice production. In the Third Five-Year plan the relative importance of the irrigation program cannot be decreased if we are to attain self-sufficiency in rice supply. Policy planners need empirical knowledge for an optimum allocation of the limited funds for various water resource development projects.

So far the importance of a stable growth of rice production to meet the steadily increasing demand for rice has been stressed. Another factor which adds to the rice problem in Korea is that the seasonal price of rice fluctuates so widely that consumers as well as producers would suffer without the participation of the government to reduce the price fluctuation.

As mentioned already, the availability of rice for domestic consumption increased significantly in the post-1945 period and throughout the period of the 1950's. Even so, the seasonal price of rice in the free market fluctuated very widely.

In the period from 1945 through the 1950's, the highest price in the spring or summer was often double that of the lowest price in the harvest season. Many factors contributed to the extreme price fluctuation - immediate need of cash by poor farmers, imperfect market, chronic inflation, political uncertainty and social disorder,etc. Thus, urban consumers always felt that rice would be short in the market in the following spring in spite of the adequate production of rice to meet the annual demand. Consequently, the government had to exercise control in an attempt to reduce the extreme seasonal price fluctuation. In order to do so, the government had to obtain and hold a certain amount of rice.

In the 1950's, the government faced less difficulty in obtaining and holding rice for price control. The land tax paid in rice and the rice received from former tenant farms under the repayment program for distributed land were the major sources of government rice.

In the 1960's, however, the government faced increasing difficulty in getting enough rice from domestic production for control purposes. The repayment program from former tenant farms faded in the latter part of the 1950's. The rice revenue from land tax was sufficient only for army and other public uses. Hence, the rice for price control had to be purchased directly from rice producers. The government fund for the purchases of rice limited and the government had to be concerned over the increase in money supply during the harvest season due to the government purchase of rice. Hence, under the fund constraint the government was unable to offer an attractive price to farmers for the purchase of rice. Consequently, the government could not obtain enough rice from domestic production. Meanwhile, rice dealers and rice producers were holding rice for speculation, since they knew that the rice held by the government was not enough to affect significantly the price determination of the next spring and summer. Under such an uncertain situation the government had to rely on imported rice for price control. The possibility of importing rice under long-term credit had an effect on the government's decision to increase rice imports in recent years.

The amount of government-controlled rice in 1957 is shown in Table 6. From the middle 1950's to the middle 1960's the government-held rice each year ranged somewhere between 300,000 tons to 400,000 tons, and most of this was obtained from domestic producers. The government-controlled rice was about 10% of the total domestic consumption of rice in these years.

In the late 1950's the amount of government-held rice was ncreased to over one half million tons, with imported rice eing the important portion. The droughts in the 1968 and 1969 ice years were responsible for the rapid increase of imported ice and of government-held rice too.

As the amount of government held rice increased rapidly in he 1967-1969 rice years, the seasonal price fluctuation of ice became stable. Table 7 shows the price gap of rice between he month in which the average price was the highest in the year nd the month in which the average price was the lowest. In the 969 rice year, for example, the average price of the highest onth was 5,798 won per 100 liters, while that of the lowest onth was 4,751 won. Hence, the price gap was 2[illegible]% in the rice year, ithout adjusting for the general price increase. In the 1968 ice year, it was 37.6%.

As the government becomes increasingly successful in reducing he seasonal price fluctuation of rice, the profit rate of rice dealers ecreases. Considering the existing interest rates and storage osts, the market price of rice in September, which is the month efore the harvest of new rice, must be about 20% more than the rice at harvest time in the previous year. Otherwise the arketing investment of rice dealers will be shifted to other ncome opportunities. In this connection the answer for the xtent to which the government should participate in controlling he price of rice is not yet clear. Each spring and summer a ame is being played with rice prices, with the rice producers nd dealers on one side and the government on the other. t is likely that the same situation will continue in the Third ive-Year Plan period with an increasing trend of government articipation. As the role of government increases to stabilize he rice market and for income subsidization of rice producers, he efficiency of government operation of grain inventories will ecome an important factor affecting the welfare of consumers as ell as producers. 8/

The government's intention to increase rice imports in order to tabilize the market price producers worried excessive rice imports y reduce their production incentives. Hence, a careful rice ice policy is required to attain the two purposes : price tability and adequate production incentive for rice producers.

The speculative nature of the rice market by season is educed significantly after July, depending upon the yield of arley harvested in June and the rainfall during the rice ransplanting season, which is finished by the early part of July. Here again we notice the importance of barley production to upplement for the shortage of rice and to reduce the uncertainties n the rice market. If barley production were reduced significantly he requirement of government-held rice would increase very rapidly.

At this point let us turn our attention to the per capita consumption of barley, which is the second most important cereal for domestic consumers.

The per capita consumption of barley ranged from 50kg to 70kg in 1957-1969 (Table 2). Barley is regarded as inferior to rice by domestic consumers, especially among urban families. The income elasticity of barley consumption is zero or negative. However, if the relative price of rice goes up, the substitution of barley for rice is rather elastic for farm and low income urban families.

As urban population and consumer income increase, the per capita consumption of barley is likely to decline, and the economic incentives for barley production will be lowered further from the present already low level.

In spite of the declining trend of incentives for barley production the farmers in southern provinces will have to continue to produce barley in the winter season, for the alternative use of cropland in the off season is still limited for most farmers. 9/ Thus, barley will be produced in spite of its low profitability, and this will contribute to supplement the shortage of rice for the economy as a whole. Because of these reasons, policy measures to encourage barley production will be needed as well as for increasing rice production in the Third Five-Year Plan.

Traditionally, wheat has been a minor item in staple food consumption in Korea. The total domestic production of wheat was about one-fifth of barley production and one-tenth of rice production. However, the import of wheat under food aid programs in the 1960's has raised the relative importance of wheat in grain consumption. As shown in Table 2, the per capita consumption of wheat in the late 1950's was around 25kg, which was about one half of the per capita consumption of barley. As we have seen already in Table 1, wheat imports increased rapidly in the late 1960's, and the per capita consumption of wheat increased to 50kg. Thus, the wheat consumption level nearly doubled during the last 10 years. Taking into account the significant increase in per capita real income in the 1960's, t[illegible]end of wheat consumption implies a high positive inco[illegible]ect.

As the import demand for [illegible] has increased so rapidly in recent years, the import requirement of wheat for the Third Five-Year Plan has become a problem of serious concern to policy planners, for the foreign exchange requirement is increasing rapidly. A reliable quantitative projection for the future demand for wheat is difficult for a number of reasons. Above all, the annual import of wheat in the 1950's was not necessarily the reflection of the domestic market for wheat, for most of the wheat was provided under food aid programs for rehabilitation of the economy from the war destruction in 1950.

A considerable part of the wheat was consumed simply because it was granted. In Table 1, we should notice the extreme irregularity of wheat imports by year. For example, in 1958, about one half million tons of wheat were imported, but only 200,000 tons in 1959. The increase in domestic grain production between these years was more than offset by the decrease in imports. Thus, the extreme irregularities in wheat imports which have been heavily affected by decisions in aid programs, make the statistical fitting so poor that the precision of demand projections based upon the time series data becomes low. If we extend the recent trend of wheat imports, then unreliably large projections of wheat imports will result.

On the other hand, the existing urban and rural household surveys report only the wheat consumed within households. In fact, however, most wheat is consumed outside of individual households, in restaurants, food stores, and especially breweries. Hence, the existing cross section data has a serious defect in the demand projection of wheat.

Information on the wheat flour allocated for various types of uses would be a great help for projection of future demand. Use of wheat flour for making noodles, breads, and confections has increased rapidly in recent years. But the author was unable to obtain information on the allocation of wheat flour for these new forms of food.

The imported wheat in recent years is regarded as exceeding the demand for wheat flour for noodles, breads, and confections, etc. Consequently, as the relative price of wheat flour to other food grains has declined (see Table 3), wheat flour is used increasingly for brewery material for the alcoholic beverage, makoli. Traditionally, makoli was made from rice and it has been the most common alcoholic drink for farmers in Korea. In the post-1945 period, when the availability of rice for domestic consumption increased suddenly, as mentioned previously, rice was used exclusively for the brewing of makoli. As the domestic consumption of rice increased more rapidly than the increase in domestic production, the government put a restriction on the exclusive use of rice for makoli. Wheat flour has rapidly become a substitute for rice in recent years. 10/ Reliable information is not available on the yearly amount of wheat flour allocated for makoli. Some officials say that 30-40% of the total imported wheat might have been used for makoli in recent years. In 1969, 1.4 million tons of wheat were imported. These 0.4-0.5 million tons of wheat may have been used for makoli production.

Therefore, in an estimation of import demand for wheat flour in the Third Five-Year Plan the grain requirement for brewery production should be taken into account in addition to the wheat flour for bread, noodles, confections, etc.

The consumption of bread, noodles and confections, etc., is closely associated with urban-industrial growth. Also, the substitution of wheat flour for rice by urban consumers is closely associated with the availability of or the relative price of livestock products such as dairy products, meat, eggs, etc. In this connection, the economy in Japan is far more urbanized and industrialized than in Korea. It is generally observed that western forms of food have been introduced extensively in Japan. Hence, the per capita consumption of wheat in Japan may provide us a reference for the future demand for wheat in Korea.

The per capita consumption of food grains in Japan for the last 15 years is shown in Table 2. In Korea, rice, barley and wheat are the main staple food grains. In Japan, rice and wheat are the major cereal foods. The per capita consumption of rice in Japan was at the level of 120-125kg in 1955-1965, and declined to a 110kg level in the late 1960's. On the other hand, the per capita consumption of wheat increased from 40kg in the 1950's to 50kg in the late 1960's. But, the per capita consumption of wheat has remained at a 50kg level in recent years. Here, we should recall that the per capita consumption of wheat in Korea has reached 50kg in recent years. But, observers would agree that western forms of food, particularly bread are more widely adopted in Japan than in Korea. The increasing use of wheat flour for brewery material for makoli is a factor explaining the same level of wheat consumption in Japan and Korea.

In Japan, as the per capita consumption of wheat has stabilized at a 50kg level in recent years the annual import demand for wheat has stabilized at around 4 million tons. The current population of Japan is about 3 times that of Korea. Hence, if we could assume that the per capita consumption of wheat in Korea will remain at a 50kg level, then, the annual import demand for wheat in the Third Five-Year Plan will be around 1.5 million tons.

In Table 2, we can notice two different facts in food grain consumption between Japan and Korea. One is that the per capita consumption level in Korea is significantly higher than that of Japan, and the other is that the per capita consumption of cereals in Korea has increased as the economy developed rapidly in the 1960's, while the per capita intake of cereals in Japan shows a declining trend.

As of 1968, for example, the Japanese per capita consumption of the two major cereals, rice, wheat, was 160kg (110kg of rice, 50kg of wheat). In 1960, the per capita consumption of the three major cereals in Korea was 211kg, while the consumption level of the two cereals in Japan was 166kg. Thus, the cereal consumption in Korea increased from 211kg to 244kg in 1960-1968, while it decreased from 166kg to 160kg in the same period in Japan. Wheat was the major item that increased in Korea, and rice was the major item that decreased in Japan.

The large gap in amount of intake of cereals between Japan and Korea implies an existence of a large difference in protein and other food intakes between the two countries. In fact, the consumption level of livestock products and sea foods in Japan is significantly higher than that in Korea.

For example, the difference in the per capita consumption of corn for livestock feeds between the two countries indicates the difference in the consumption of livestock products. Presently, the per capita consumption of corn in Korea is a little less than 10kg per year, while it is around 50kg in Japan, and most of the corn in both countries is used for feeding livestock. The potentials for domestic production are limited in the two countries. Therefore, the major part of the corn is imported. In 1970, the corn import in Korea is expected to be around 250,000 tons. Presently, around 4 million tons of corn are imported in Japan.

It is likely that the import demand for corn to feed livestock will increase more rapidly than the import demand for wheat. In the middle 1960's around 50,000 tons of corn were imported per year in Korea, but the import demand is likely to increase to one-half million tons by 1976.

As urban-industrial growth continues in Korea the substitution of wheat flour for rice and barley will increase. Even so, rice will remain the most important portion of cereal intake. Hence, the import demand for wheat will be stabilized at a certain level. On the other hand, the import demand for livestock feed will increase continuously in accord with the urban-industrial progress. In the long run, the foreign exchange requirement for feed import will become larger than that for wheat import.

III. Public Programs for Increasing Rice Yield

The political and social uncertainties that prevailed after World War II, and the Korean War incidence in the early part of 1950, also, the relative abundance of rice supply in the domestic market due to the cessation of rice export to Japan after 1945, etc., caused stagnation of rice yield growth, and significant public programs were not implemented for rice yield growth in these periods.

Extensive and ambitious public programs for rice production were implemented from the early 1960's, when the 1st Five Year Economic Development Plan (1962-1966) was initiated. In the Plan period, the public programs for rice production emphasized (1) construction of water reservoirs to irrigate rain-fed paddy lands, (2) construction of fertilizer plants and distribution of agricultural chemicals, (3) strengthening of agricultural extension and experimental work, (4) reproduction of recommended seeds and distribution to farm level through demonstration plots, (5) government subsidy for agricultural limestone use on high-acid paddy soil (6) government subsidy for introduction of motor tillers, power sprayers, water pumps, etc.

Thus, the main emphases were for irrigation, land improvement, and adequate supply of new inputs including research and extension services.

As the suitable location for water reservior construction diminishes, the cost of irrigation by building reserviors tends to increase. In the 2nd Five Year Plan (1967-1971), a tube well program was added to the conventional reservoir method. The proportion of irrigated paddy land to total area of rice paddies will be increased from 60% in 1963 to 80% by 1972. In the Third Five Year Plan (1972-1976) construction of multipurpose dams along the five major rivers will contribute substantially to controlled water supply in rice production. The policy emphasis on fertilizer plant construction in the 1st Plan period was shifted to optimum fertilizer mix at the farm level.

One of the important programs undertaken in the 2nd Plan period was the extensive participation of farmers in paddy land rearrangement, by which paddy lands are utilized more intensively with increased labor efficiency. Most of the paddy land suitable for rearrangement is to be consolidated by 1976. About one half of the total area of paddy land is estimated as suitable for rearrangement.

Irrigation and land consolidation have provided the base for joint cultivation of rice by groups of smallholders. About 20% of the total area of paddy land is jointly cultivated. For example, 10 to 20 farmers work together in application of yield increasing inputs, such as selection of seed, preparation of seed beds, transplanting work, weeding and fertilizer mix, group control of insects and plant diseases, etd.

Increasing outflow of rural young labor force to the rapidly growing urban-industrial sector is causing a faster increase in the rural wage rate than in labor productivity. Labor shortage in the peak season is becoming a restricting factor for increasing rice production. Substitution of capital for labor in rice production is lagging due to the high price of capital. High seasonality in crop production, undeveloped feeder roads and village roads, infant stage of mechanical industry, limited experiences of farmers in handling power machines, expensive repair service, etc. are the restricting factors for elastic substitution of capital for labor.

In the period 1960-1967, the low level of rice prices relative to non-farm goods was a cause of complaint among farmers in producing more on the given land. Since 1967, however, the real domestic price of rice has increased annually even though the amount of imported rice has increased rapidly. The real domestic price of rice is likely to continue to increase for the next few years.

As the price of rice has risen,farmer's complaints on the output price have been reduced in these years. On the other hand, thoughtful farmers are concerned more about price rigidity in the market for industrial goods, domestic production of which has increased rapidly in the last few years.

In order to achieve the target self-sufficiency in rice by the mid le 1970's the degree of supply response in rice production is a key item of information to be investigated. Very limited information is available on the supply elasticity of rice in the Korean agricultural setting. Irrigation, land improvements, local availability of new inputs, etc. have improved substantially in the last ten years. Quantitative measurements of the impacts of these improvements on the growth rate of rice yield will be useful for future prediction. From the author's recent field surveys talking with guidance workers at the village level it was found that farmers are becoming interested in yield increasing technology.

The following are the particular interests of rice producers in these days : a) high-yield varieties, b) proper fertilizer mix for paddy land, c) weed killers, d) use of burned lime stone, e) group control of insects and plant diseases, f) paddy land rearrangement and feeder road development.

In the 3rd Plan period (1972-1976), the domestic price of rice is likely to increase faster than the general price level. Hence, the output price should not be a serious restricting factor for increasing the rice yield,

IR-667, which is a hybrid of new varieties in IRRI and a Japonica variety, developed in the rice experiment station in Korea, is expected to contribute significantly to yield growth in the next few years in the agricultural regions where paddy land is well irrigated and soil fertility is superior.

Since most of the paddy land suitable for land consolidation will be rearranged by 1976, the group control of yield-increasing technology by joint cultivation systems will be extended further in the major rice producing areas. Increasing shortage of farm labor force in the peak season is a factor inducing the joint cultivation and group control of production technology. Also, paddy land rearrangement and joint cultivation are an institutional factor providing opportunities for introducing power machines, such as tillers, motor sprayers, power thresher high powered water pumps, etc.

However, in the early stage of rapid urban-industrialization progress, policy programs for making desirable input-output relations in the rice producing sector seem not sufficient for a yield take off. Inconvenient or inefficient rural life environments compared to urban life affect the incentives of rice producers. Farmers are not happy just because of high price and abundance of fertilizers. They also want to have electric lights, telephones, paved local roads, sanitary water supply, education and health service, etc. The solution of rice problems in the Asian economic environment seems not the subject for agronomists or the Agricultural Ministry alone, but it is becoming increasingly the subject for non-agronomists and for other ministries in the government.

Footnotes

1/In Korea, food grains include corn, barley and other so-called "coarse" grains as well as typical food grains.

2/Wheat production as a winter crop requires more growing days than barley and this affects yields of summer crops, such as rice on paddy land, soybeans and sweet potatoes on up upland.

3/Wheat imported under aid programs in the 1950's was often consumed in a primitive form of food by low income families, mainly due to the shortage of sugar and the poor facilities of the baking industry in those days. The baking industry developed significantly in the 1960's, and new forms of food such as breads, confections, etc., which are made from wheat flour, are consumed as an expensive food by urban consumers. The wheat imported in the late 1960's exceeded the wheat needed for restaurants and bakeries. Consequently, a substantial portion of the imported wheat is being used as the ingredient for the local alcoholic beverage called " mackolli". Formerly, rice was the major ingredient for mackolli.

4/The annual domestic consumption of rice was measured by taking into account domestic production, import and export, and inventory carry-over of rice in each respective year. Then, the total consumption of rice was divided by the total population to get the per capita consumption. During the period 1956-1969, the per capita consumption of rice has increased by 0.26kg per year, on the average : Y=1.27kg + 0.26kg (X), where Y is per capita consumption of rice in kg and X is the year of observation.

5/The author's calculation from urban and rural household survey data of 1959 turned out 0.45 for farm families and 0.3 for urban families. Jin H. Park: "Economics of Resource Use on Rice Farms in Korea ", Ph.D. Thesis, Univ. of Minn., 1963.

6/In the pre-1945 period, around 30-50% of the total rice production in Korea was exported to Japan. Rice rent paid to landlords contributed to the export by restricting the rice consumption in farm households.

7/The measured regression equation is Y=2,764 + 71.1 (X), where X is the year observed and Y is rice production in 1,000 tons. Hence, on the average, rice production increased by 71,000 tons per year during the period.

8/In Japan, most of the market surplus of rice on individual farms is purchased by the government under the dual rice price policy. As a consequence of this the role of rice dealers has decreased to a delivery store for the government controlled rice. In Taiwan, the role of rice dealers has reduced significantly as the government participation for rice price control has increased.

9/In areas close to cities in the southern province winter vegetables and special cash crops are produced instead of barley or wheat. On dairy farms forage crops will be a substitute product for barley.

10/Once the government enforced the use of barley for Mackolli, but the sales of Mack6lli were reduced greatly due to the inferior taste of the drink. On the other hand, the consumption of distilled alcohol increased. Yet, farmers favor wine made from food grains over distilled alcohol, especially during work in the fields.

Table 1. Domestic Production and Import of Food Grains in Korea, 1956-1969

Rice year 1/	Domestic production (1,000 m/t)						Net import (1,000m/t) 2/						Total supply for domestic consumption	Imports as percent of total supply
	rice	barley	wheat	beans	corn	Sub-total	rice	barley	wheat	beans	corn	Sub-total (1)	(2)	(1)/(2) %
1956	2,959	1,091	218	149	13	4,430	4	166	223	42	0	435	4,865	8.9
1957	2,438	950	218	153	11	3,770	202	200	420	33	36	891	4,661	19.1
1958	3,002	1,183	223	153	14	4,575	23	223	499	65	72	882	5,457	16.2
1959	3,161	1,359	267	153	14	4,954	4	22	191	29	1	247	5,201	4.7
1960	3,150	1,370	258	138	14	4,930	0	0	392	36	48	476	5,406	8.8
1961	3,047	1,478	280	130	14	4,949	0	123	355	22	43	543	5,492	9.9
1962	3,463	1,378	268	165	16	5,290	0	30	406	16	36	488	5,778	8.4
1963	3,015	918	228	156	18	4,335	118	170	826	10	89	1,213	5,548	21.9
1964	3,758	1,515	309	156	20	5,758	0	151	630	9	64	854	6,612	12.9
1965	3,954	1,807	300	165	35	6,259	0	71	517	0	62	650	6,909	9.4
1966	3,501	2,018	315	174	40	6,048	31	0	503	0	33	567	6,609	8.6
1967	3,919	1,916	310	161	34	6,340	113	0	922	29	49	1,113	7,453	14.9
1968	3,603	2,084	345	201	60	6,293	216	106	1,067	17	131	1,537	7,830	19.6
1969	3,195	2,066	366	245	63	5,935	755	67	1,369	24	174	2,389	8,324	28.7

1/ Rice year is slightly different from calendar year. For example, from November of 1968 to the end of October of 1969 is called 1969 rice year. The harvest of rice, the most important food grain, begins in October and this rice is consumed until the next year's harvest.

2/ The grain export in the period was a negligible portion of the domestic production, and the exported grain was subtracted from the imported grain to get the net import.

Source : Ministry of Agriculture and Forestry(MAF) Working Group for Projection of Food Demand for the Third Five-Year Plan

Table 2. Changes in Per Capita Consumption of Food Grains in Korea and Japan, 1956-1969

Year	Korea						Japan				
	Rice	Barley	Wheat	Soybean	Total	Per capita real income (at 1969 price)	Rice	Barley	Wheat	Soybean	Total
	(kg)					(won)	(kg)				
1956	-	-	-	-	-	-	119.6	21.3	38.1	12.9	191.9
1957	127.0	55.8	24.1	8.5	215.4	22,421	124.1	20.6	39.1	14.0	197.8
1958	123.8	50.3	29.7	8.8	212.6	23,349	121.1	18.7	39.1	14.6	194.5
1959	130.0	52.0	24.7	8.5	215.2	23,820	121.5	15.8	40.9	16.2	195.0
1960	129.2	59.7	22.2	7.3	218.4	23,922	123.0	13.3	42.5	16.2	195.0
1961	125.5	68.0	25.3	6.5	225.3	24,005	126.2	13.7	43.9	16.6	200.4
1962	126.3	59.3	25.5	6.5	217.6	23,231	126.9	11.9	44.3	16.8	200.0
1963	124.4	53.8	33.4	6.6	218.2	25,050	126.5	8.9	44.0	19.5	198.9
1964	126.3	48.8	36.3	6.1	217.5	26,475	125.0	9.6	45.7	19.4	199.7
1965	137.2	54.4	36.0	5.6	233.2	27,777	120.6	9.6	47.1	22.1	199.4
1966	130.7	63.0	28.6	5.6	227.9	29,908	114.9	9.8	50.3	23.6	198.6
1967	127.8	67.6	33.0	6.2	234.6	32,416	113.1	9.8	50.9	24.0	197.8
1968	129.8	69.9	43.9	6.9	250.5	35,205	109.6	9.5	50.3	25.6	195.0
1969	126.7	69.6	51.1	6.9	254.3	39,405	-	-	-	-	-

*** Source : MAF, Working Group for Projection of Food Demand for the Third Five-Year Plan**

Table 3. Real Price Index of Grain and Other Foods 1)

Rice year	Rice	Barley	Wheat flour	Soy-bean	Corn	Beef	Pork	Chicken	Egg	Milk	Fish	Seaweed
						(Percent)						
1956	115.3	113.2	100.7	60.3	-	81.6	70.0	75.5	81.6	-	-	-
1957	108.4	120.1	92.1	62.8	-	85.1	79.1	75.5	81.6	-	-	-
1958	98.9	98.9	87.1	61.9	-	92.2	86.4	88.1	97.7	-	-	-
1959	85.3	74.4	76.9	54.7	-	93.6	84.5	91.2	89.7	-	-	-
1960	91.1	85.8	76.3	77.5	94.0	108.5	80.0	80.5	79.3	-	-	-
1961	99.1	105.0	92.8	69.0	101.1	112.1	80.0	77.4	75.9	-	100.0	102.1
1962	95.0	108.6	88.1	66.2	100.6	109.9	89.1	81.1	78.2	105.9	96.7	82.5
1963	124.8	143.4	71.6	92.3	129.9	96.5	79.1	73.0	77.0	88.2	101.1	74.4
1964	114.8	139.0	88.8	71.8	158.3	83.7	80.9	76.7	85.0	91.2	97.7	81.4
1965	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1966	94.5	87.6	92.6	104.3	111.7	104.3	97.3	97.5	94.3	100.0	108.7	107.2
1967	97.4	95.6	84.0	128.3	112.6	127.7	108.2	142.2	96.6	108.8	125.0	111.3
1968	103.0	91.8	79.1	78.7	112.4	191.7	140.9	156.6	85.0	105.9	138.0	110.3
1969	117.1	92.2	76.0	87.9	102.8	191.5	139.1	113.2	83.9	111.8	131.5	124.7

1/ Current price at wholesale level for each food item was converted into current price index taking 1965 price as the base. Then, the current price index was divided by the wholesale price index for all commodities to get the real price index of food items.

Table 4. Income Elasticity of Demand for Rice, Measured by Time Series Data in 1957-1969

Dependent variable	Independent variables			Income elasticity 1/
	X_1 (Income)	X_2 (Relative price)	X_3 (Relative price)	
(1) R/N	GNP/N	Pr	-	+ 0.013
(2) R/N	GNP/N	Pr/Pb	Pr/Pw	+ 0.059
(3) R/N	GNP/N	Pr/Pg	-	+ 0.026

R/N ..... Per capita consumption of rice
GNP/N .... Per capita real income
Pr ...... Real price of rice
Pr/Pb .... Relative price of rice to barley
Pr/Pw .... Relative price of rice to wheat
Pr/Pg .... Relative price of rice to other grains

1/ Elasticities were calculated by the logarithm function

$$Y = kX_1^{a} \quad X_2^{b} \quad X_3^{c}$$

* Source : MAF Working Group for Projection of Food Demand in the Third Five-Year Plan

Table 5. Annual Variation of Rice Production in Korea and Japan 1956-1969

Rice year	Korea			Japan		
	Total production of rice (actual) (1)	Fitted value of rice production (2)	Deviation $\frac{(1)}{(2)} - 1$	Total production of rice (3)	Fitted value of rice production (4)	Deviation $\frac{(3)}{(4)} - 1$
	(1,000 M/T)		(%)	(1,000 M/T)		(%)
1956	2,959	2,835	+ 4.4	10,899	11,381	- 4.2
1957	2,438	2,906	- 16.1	11,464	11,595	- 1.1
1958	3,002	2,977	+ 0.8	11,993	11,808	+ 1.6
1959	3,161	3,048	+ 3.7	12,501	12,021	+ 4.0
1960	3,150	3,120	+ 1.0	12,858	12,235	+ 5.1
1961	3,047	3,191	- 4.5	12,419	12,448	- 0.2
1962	3,463	3,262	+ 6.2	13,009	12,661	+ 2.7
1963	3,015	3,333	- 9.5	12,812	12,874	- 0.5
1964	3,758	3,404	+ 10.4	12,584	13,088	- 3.9
1965	3,954	3,475	+ 13.8	12,409	13,301	- 6.7
1966	3,501	3,546	- 1.3	12,745	13,514	- 5.7
1967	3,919	3,617	+ 8.3	14,453	13,728	+ 5.3
1968	3,603	3,688	- 2.3	14,449	13,941	+ 3.6
1969	3,195	3,759	- 15.0			

Table 6. Proportion of Government - Controlled Rice to Total Domestic Consumption of Rice, 1957-1969

Rice year	Total domestic production of rice	Total domestic consumption of rice (1)	Government-controlled rice			Proportion of government controlled rice to total domestic consumption (2)/(1)
			Purchased from domestic producers	Imported rice for price control	Total (2)	
	(1,000 m/t)					(%)
1957	2,438	2,740	119	202	321	11.7
1958	3,002	3,025	186	23	209	6.9
1959	3,161	3,165	265	4	269	8.5
1960	3,150	3,150	377	0	377	12.0
1961	3,047	3,047	250	0	250	8.2
1962	3,463	3,463	470	0	470	13.6
1963	3,015	3,133	303	118	421	13.4
1964	3,758	3,758	273	0	273	7.3
1965	3,954	3,954	357	0	357	9.0
1966	3,501	3,532	296	31	328	9.3
1967	3,919	4,032	288	113	401	9.9
1968	3,603	3,819	399	216	615	16.1
1969	3,195	3,950	250	755	1,005	25.4

Table 7. Rice Prices Between Highest and Lowest Month Within Rice Year, 1962-1969

Rice year	Monthly average price in November and December in the harvested year (1)	Monthly average price in July and August in the next year (2)	Rate of price increase within a rice year (2)/(1)	Average price in the lowest month (A)	Average price in the highest month (B)	Rate of price increase within the rice year (B)/(A)
	won/100 liters	won/100 liters	(%)	won/100 liters		(%)
1962	1,418	1,568	10.6	1,376	1,877	36.4
1963	1,779	4,172	134.5	1,767	4,117	133.0
1964	2,544	3,630	42.7	2,513	4,240	68.9
1965	2,976	3,474	16.7	2,916	3,487	19.6
1966	2,967	3,631	22.4	2,922	4,186	43.3
1967	3,140	4,118	31.1	2,123	4,120	31.9
1968	3,565	4,544	27.5	3,546	4,879	37.6
1969	4,782	5,778	20.8	4,751	5,798	22.0

APPENDIX

Table A 1. Area planted to rice and other crops in hectares, 1969

	Rice paddies	Non-rice paddies	Total
	------(1,000 hectares)	-----------------	
Total cultivated hectares	1,294	1,037	2,331
Total irrigated hectares	817	0	817
Effective crop area	1,941	1,634	3,575
Land in rice			
irrigated			817
rainfall			391
upland			24
deep water			-
Total			1,232
Land in HYV			
Land in wheat			154
Land in other food grains (Barley, Sorghums, Millets)			1,110

1/ The IR-667, which is a hybrid of HYV in IRRI and Japonica, will be planted on 300,000 hectares (about 25% of the total area of paddy lands) from 1973.

Source : Official statistics presented by the Ministry of Agriculture and Forestry, Republic of Korea

Table A 2. Current factor and product - 1970

Price of rough rice or paddy/kg :	58 Won a/
Price of nitrogen/kg :	27 Won
Institutional credit rate/year :	10-15 %
Wage for farm hired labor/day :	500-600 Won
Land value - single crop	900,000 Won
Land value - double crop irrigated paddy/ha.	1,200,000 Won
Irrigation fee/hectare/crop (rice only)	4,860 Won
Rental sharing arrangement for tenants b/	

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a/ 315 Won is equivalent of one U.S. dollar

b/ Tenancy is prohibited by the Land Reform Law of 1950. Even so, tenant farms are emerging partially, and tenants are paying about 30% of the total rice produce to the landowners.

Source : Official statistics presented by the Ministry of Agriculture and Forestry, Republic of Korea.

Rice Policy in the Philippines

Jose M. Lawas and Gerald E. Korzan *

INTRODUCTION

Rice is the most important food crop in the Philippines. It is consumed by about 80 percent of the people (1). In 1971, roughly 3.2 million hectares which is about 40 percent of the total arable land area in the country is devoted to the production of this cereal (2).

Prior to the late 1950's, the land area in rice was growing over time at about the same rate as population. In 1949 the area in rice was 2.2 million hectares (3) and by 1959, the area had increased to 3.3 million hectares, an increase of 50 percent which roughly equalled the increase in population during the same period. It was estimated that land input accounted for most of the growth in rice output during that span of time (4). Since 1959, the land area in rice has been remarkably stable ranging from about 3.1 to 3.3 million hectares each year. It is interesting to note that since crop year 1964-65, the structure of the rice industry has been characterized by a declining trend in upland rice hectarage and an increase in lowland area. Increased double cropping of lowland areas implies that the best land is being more and more effectively utilized. Apparently, this accounts in pact for the noticeable increases in rice productivity in recent years.

Table 1 shows what has happened since 1965 and most notably since 1969. These data show that between June 30, 1969 and June 30, 1971, palay production is estimated to increase by nearly 20,000,000 cavans on 200,000 less hectares of total palay area. The 27 percent increase in yield is indeed a dramatic breakthrough in rice production in this country. From 1968 to 1970, no rice was imported. Effective demand increases from 3.5 to 4.0 percent per year. A surplus may exist in 1971, but with decreased buffer stocks likely to amount to less than the required level of 10 percent of total production (5).

It is worth noting that the income elasticity of demand for rice is low, perhaps in the range between 0.1 and 0.2 which indicates that consumption needs are well satisfied at the relatively low income levels prevailing in the Philippines, particularly the rural areas (6).

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The price elasticity of demand for rice is estimated at -.23 which, of course, means consumers will consume a little less when the price rises relative to other prices (7). During the past year the price of rice has risen but so have the prices of other basic commodities.

The increase in rice production is all the more dramatic when one knows that losses due to typhoons late last year reduced the 1971 estimate by 9,600,000 cavans and harvested area by 200,000 hectares (8). There is much built-in technology which will make itself apparent during the very next favorable weather year. Furthermore, average yields of rough rice are still low by any standard being only 1.8 tons per hectare. There are many farms obtaining yields of 3.0 to 3.5 tons per hectare. A few obtain yields of over 100 cavans which is equal to about 4.5 tons per hectare.

It is the purpose of this paper to briefly outline the rice policy of the Philippine grovemment of recent years that helped generate this substantial increase in rice output. It aims to indicate also what needs to be done, as a matter of future policy formulation, in the rice industry in the years ahead in the light of problems and constraints that prevail in the country.

RECENT GOVERNMENT RICE POLICY

At the outset, it is important to point out that in the Philippines it is the private sector that has the responsibility for production and the manner in which resources are utilized. The fact is that "the burden of actually carrying out the targets for agriculture must rest on the private sector. The public sector's role is that of providing the necessary incentives and supporting infrastructure. These include the provision of more liberal credit; the establishment of an efficient marketing system not only in the metropolitan areas but also in the provinces; the construction of necessary facilities such as irrigation feeder roads, etc.; the provision of effective assistance in production and marketing, especially for export products; and the continued implementation of the land reform program" (9). In effect, the government plays the role of the architect in the growth process and even provides some of the building blocks, but it is the private sector that must actually do the task. In government policy formulation, a recurring theme would then be that of increasing the degree of economic freedom, growth and stability with greater reliance on the market mechanism in the allocation of products and resources (10). This is true not only for the rice industry but also for all aspects of economic activity.

Administering Agency for Rice Production

In recent years, most guidelines on rice production usually emanate from an agency of the government known as the Rice and Corn Production Coordinating Council (RCPCC). The RCPCC was created years ago but its operation was ineffective during the period prior to the mid 1960's. In 1965, this Council was revitalized, with the Executive Secretary of the President, an extremely capable member of his cabinet, and with authority to mobilize any agency in the government or private sector to assist him, as Action Officer. The permanent Chairman of the Council is the Secretary of Agriculture and Natural Resources and, at that time, he was also the Vice President of the Philippines. Actually, the RP President and Vice President presided over most of the meetings of RCPCC and take personal interest in the activities of this agency. Consequently, it became obvious to the people both in the government and the private sector that the highest Administrators of the country themselves are directly and deeply involved in the program. An Executive Director with wide experiences and imagination was employed, together with experienced people from agriculture, economics, financial institutions, military, universities, and other agencies involved in the rice industry.

The RCPCC is responsible for managing the national rice and corn production programs. In its operation, it initially divided the country into three priority areas consisting of only 14 of the more than 50 provinces. It was felt to be desirable to concentrate increasing output in those areas where the rice crop was the most important. Furthermore, the strategy was to concentrate relatively more effort in priority area I, which is Central Luzon, the rice bowl of the Philippines. Besides, infrastructure, such as irrigation systems, roads, communication, credit institutions, warehousing and milling facilities, are more developed in Central Luzon than elsewhere in the country. It was believed that further development would proceed most rapidly where in fact developed was already underway (11).

The RCPCC played the major role in increasing rice productivity since 1966. This agency effectively coordinated its more than 15 member agencies by focusing their efforts on the central problem of closing the gap between rice production and consumption (12). Extension work, fertilizer tests, soils management, plant protection, new varieties and cultural practices, storage, drying, processing, credit, cooperatives, and price supports were intensified to help solve problem areas that have received continuing attention from the government.

In brief, the three basic reasons that the RCPCC became a viable action public agency in recent years were (a) highly qualified personnel, (b) a reasonably adequate budget and (c) sensible activities. Its program was geared to the promotion of planting high yielding rice varieties and the package of cultural practices required. Research institutions, notably the International Rice Research Institute, the College of Agriculture of the University of the Philippines, and the Bureau of Plant Industry, have continuously played an important role individually and through their cooperative efforts in providing new high yielding varieties.

Rice Price Policy

The government price support policy has two general objectives which are (a) to support farm prices at reasonable levels and (b) to keep consumer prices at levels which are in line with the incomes of the bulk of consumers.

Before the de facto devaluation of the peso in February 1970, the support price of a cavan of palay was the equivalent of about $4.10 which together with milling and storage cost brought the price of milled rice in the wholesale market to about $200 per metric ton. With a world price of about $155 per ton in February 1970, exports of white rice, 5 percent broken, if made would have needed to be subsidized by about $45 a ton (13). Since devaluation, the same quality rice could be sold in the world market for $140 a ton when paying P20.00 per cavan of palay (14). It should be noted, however, that the price of Thai rice, 5 per cent broken, was only $130 a ton in January 1971. The price of palay at the farm level has risen and now ranges from about P22.00 to P24.00 depending on the variety and region.

It can be seen that the existing price support program at the farm level is no longer effective because the market price is higher than the purchase price. In the past, although not enough funds have been available for the price support program, it had played a role in stabilizing price. Perhaps at no time has the government had in its hands even as much as 10 percent of total stocks (15). The fact that the government could and often stepped into price depressed areas and purchased palay very likely prevented prices from declining to an even greater extent.

Under the price support law, the Rice and Corn Administration is required to make available to low-income consumers in the open market, second class milled rice at the equivalent or about 22 cents per ganta (one ganta equals about 2-1/2 kilograms). The better milled rice was selling at the consumer level from a low of P1.80 to a high of P2.90 per ganta (28 cents to 45 cents), depending on the variety, in February 1971 (16). So, whenever the Rice and Corn Administration sells rice to low-income consumers it loses a minimum of 6 cents per ganta plus all carrying charges. The Rice and Corn Administration sold very little rice during the past year but, it may have played some role in keeping retial prices from rising even higher during recent months.

There is heavy pressure on the part of farmers to substantially raise the support price for palay. If this occurs, prices to consumers must also rise and this will be most unpopular at present. Then, too, substantially higher prices may make exports difficult unless subsidized by the government.

Storage and Processing

Even though much of the storage capacity of the Philippines does not measure up to a high standard, there is enough to store about one-half of all the rice and corn produced in any one year. Rough rice is stored in these facilities in sacks and piled on pallets. Bulk storage is not common. A study shows, however, how sack storage may be converted to bulk at low cost thereby increasing the capacity of existing facilities(17).

Most milling facilities in the Philippines are either commercial type mills (two composition stone hullers, a shaker-separator, and two emery- stone polishers) or the small single huller (Engelberg design). It is estimated that more than one-half of all palay is processed in commercial mills with reasonably satisfactory recovery estimated at about 68 percent by weight. These commercial mills average about 5 to 6 tons per 12 hours of operation. Some of the larger mills have a daily capacity of 20 or more tons. The milling recovery is about 60 percent in the small mills. The lower recovery with these mills simply means some rice is included with the bran thus improving the quality of the feed. Under a state of rice surplus, this practice may not all be bad and certainly increases the supply of feed which is now in short supply in the country.

There are four large modern mills with pushbutton controls and classifying equipment that can turn out rice that is 100 percent whole grain and clean. This rice is equal in quality to any sold in the world today.

Rice drying, storage, and milling does need modernizing, and should be done gradually over a period of years. A World Bank loan of about 14.3 million dollars to the Philippines is a step towards this direction.

Credit

As a policy instrument to effect increased rice productivity, a number of financial institutions have launched financing plans that

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encouraged rice farmers to shift from the planting of ordinary varieties of rice to high yielding varieties. Palay producers with farms which are assured to a continuous and fully controlled water supply throughout the year or those who are member of farmers' cooperative association can easily qualify for loans under the program. Likewise, financing of the acquisition of land, building, machinery and equipment for rice mills are also available from some banks. From the Agricultural Guarantee Loan Fund (AGLF), rice farmers can avail of credit from rural banks without collateral. In the case of non-payment by farmers, the rural bank stands to lose 30 percent of the loan value with the rest shouldered by the AGLF. In the same vein, perhaps as a form of marketing loan, farmers can deposit their rice in warehouses in exchange for a warehouse receipt (quedan) to be cashed in rural banks for purposes of purchasing production inputs.

With a rice crop valued at about two billion pesos at the farm level each year, large increments of credit are required to generate production of this magnitude. It is safe to conclude that nearly all the tenants and many of the small landowners need to borrow all or nearly all the funds needed for the production process.

The rural banking system, with 486 branches located all over the country, has done a great deal to provide credit to farmers. Appendix Table 8 shows that 145,000 rice farmers had rural bank loans in September 1970 amounting to 160 million pesos. This could be 15 to 20 percent of all credit obtained by rice farmers. In any case landlords, traders, and merchants are still the most important sources of credit. It will be a long time before commercial credit at reasonable interest rates becomes more important in terms of volume than the traditional sources.

As agriculture becomes more commercial and intensified, credit needs will increase. Severe credit restraints limit what the small entrepreneur may do. With income levels so low in rural areas, the propensity to consume will still far exceed the propensity to save even as net incomes may tend to increase.

Infrastructure

Increasing attention has been given in recent years to infrastructure programs that are important adjuncts to development. In the government's 4-Year Plan for FY 1971 to FY 1974, investments on infrastructure accounts for about 16 percent of the gross domestic investment.

Roads and highways are by far the most important receiving a budget in excess of 400 million pesos in 1971. Millions of pesos are likewise being invested in the construction of ports, harbors, airports, air navigation, railroad and portworks, in order to provide an integrated and efficient network of land, air and sea transportation facilities to service the economic activities, as well as facilitate the movement of people.

Repairing, maintaining and constructing irrigation systems is also a high priority effort in the Philippines. During the existing four-year program, the targets are aimed at improved irrigation and drainage systems of about 320,000 hectares, with yearly specific targets of 73,000 hectares in 1971, 54,000 hectares in 1972; 58,000 hectares in 1973; and 135,000 hectares in 1974.

To generate power required by expanding industries and households, particularly in the rural areas, intended investment for the four-year period, FY 1971 to FY 1974, was estimated at around 340 million pesos plus an 80 million dollars component.

Of the 4.5 billion budget in 1971-72 proposed by the President, nearly 20 percent will be spent on infrastructure which is inadequate. In light of other needs, however, this percentage may be about all that can be used in this manner. The need is recognized but there are severe budgetary constraints.

Ingredients for Success are Present

In summary, significant new technology became available in the Philippines particularly in the form of improved rice varieties. The government organized itself with excellent management to carry the new technology in package form to farmers.

Farmers responded even though they consequently began to experience a state of economic and social disequilibrium. They broke away from the traditional ways of working because it seemed to them that relatively high payoff were in prospects (18).

A general process of transformation is going on in Philippine agriculture. The present and potential successes in rice are being generalized into other development programs which include expanded production and marketing of livestock and poultry, fish, and feed grains, including yellow corn, soybean and sorghum (19). It should be emphasized, however, that rice production will continue to increase because the momentum is there and improved technological change is still in the pipeline.

FUTURE RICE POLICY

The increases in total output of rice generates problems in supply and demand estimation, distribution, equity and employment which are multidimensional and interacting. This tends to create a new situation in which a need for reform in policy becomes expedient. A modification of some existing policy instruments in rice production and marketing must be oriented in the light of the following developments in this sector.

Expertise in Rice

There has been almost a single-minded effort on the part of the Philippine government to develop rice producing expertise among farmers. To a large measure, success has been achieved with farmers enjoying the results of their efforts. There is little doubt that Philippine farmers now know more about the modern technology of producing rice than any other crop.

Farmers usually feel uneasy when introducing a new product line. There are problems arising with respect as to how to produce it, market outlets are not established, and price may be uncertain. As a matter of fact, rice farmers will simple not diversify their production unless the opportunity cost is relatively low. Thus, in the absence of information for the government to say now that farmers, at least some of them, should quit producing rice or at the very least, produce less may appear to be a poor strategy (20). In other words, if rice surpluses may develop, it is an oversimplification and unrealistic pronouncement to simply say that the future policy must be one of diversification.

Rice is Synonymous with Food

If the Philippine government were to urge farmers in given areas or farmers in general to reduce their output of rice, it would, in effect, be telling them to stop producing some of their food. In a country where rice shortages existed for nearly 100 years, up to three years ago, farmers and consumers in general want complete assurance that there is enough rice for everyone (21). At present, even in the rice bowl of the Philippines, some tenant farmers do not produce enough rice for their own use.

In spite of the fact that the marketing system probably is more adequate for rice than any other product, filipinos would like very much the assurance of adequate rice in their region. All too often traders have taken advantage of residents in areas experiencing seasonal shortages of rice. Of course, more and more reliance is being placed on exchange of goods and services, i.e., a monetized economy. Nonetheless Filipinos have been short of rice too many times to trust its production and distribution entirely to others.

Opportunity Cost

The opportunity cost of switching some rice land area to other crops is indeed high. Given the present price of rice, the technology, and frame of mind of rice producers and consumers, the Philippines will find it difficult to reduce or even slow down the output of rice untill considerable surplus exists. Surpluses will, of course, reduce prices and modify the views of the public. When this happens, it should become apparent to all concerned that some rice lands need to be shifted to other uses.

Rising Expectations

Rising expectations seem to pervade society. The green revolution has very likely contributed significantly to these feelings of Filipinos (22.) In order to achieve more of the "good life", they are likely going to want, and in fact, insist that the public and private sectors identify new incentives for them. These incentives must be real and not imaginary whether in the rural or urban areas. For the government to say, for example, there must be some crops that are more profitable than rice so farmers should search for these alternatives will bring a minimum response. Recommendations must be specific together with identification of credit lines, market outlets, and perhaps even guaranteed prices.

Research

In the final analysis, whether the Philippines has viable development programs in agriculture in the 1970's will depend to a large measure on the relevance and quality of research. Research findings have to range from those conducted with farm problems to those of a basic nature (23). Of equal importance, the Philippines should be keyed in on what is going on in research in other parts of Asia and in fact the world as related to this country. Adapting research done elsewhere to the needs of the country will stretch the research peso which will never be entirely adequate.

Up to the present, research has been heavily weighted to solving production problems. Much of this must be continued but more must be done in market organization and structure, demand, price and price policy and in the socio-economic areas (24).

Of equal importance, decision-makers need agribusiness studies of the important agricultural industries such as rice, corn, feed grains, livestock, poultry and fish. An agribusiness study will provide information on all aspects of the structure of the industry. For example, in the case of rice, this research approach will specifically provide bases to determine the present and potential importance of the rice industry to the economy; to determine present and potential demand for rice, the marketing system, and production dimensions and how these components relate to each other; and to identify strengths and weaknesses in the rice industry and propose research in the appropriate areas.

Agribusiness studies have great efficacy in generating planning and programming facts. Planners, in establishing policy and in programming the budget in realistic terms can often do so without having research results to the second or third decimal place. In fact, research results based on elaborate sample design and models for analysis often deal with the way things are and not what we would like in terms of development goals. We again say farmers in the Philippines are in a state of economic and social disequilibrium because of the new technology injected into the system and rising expectations among the people. We need more studies which indicate to decision-makers where farmers are going, not where they have been.

We subscribe to the full spectrum of research activities as identified by Moseman all of which contribute to decision-making. Carrying on these activities against a backdrop of agribusiness studies will stretch the research peso because of the relevance and quality dimensions.

Diversification

To a considerable measure general diversification of agricultural production already is a reality in the Philippines. Adjustments in agricultural commodity mixtures will take place and continue further. There is, of course, concern over the prospect of rice surpluses in the years immediately ahead. Dealing with an abundance of rice is a new experience for decision-makers in this country.

Even so the present plan is at least to push rice production and its related activities during the four-year period, 1971-1974, even if a sizable surplus may result (25). Philippine farmers know how to produce rice. We are not going to encourage farmers to change from rice to other crops until there is conclusive evidence that it is in their best interest to do sc. A Land Classification and Soil and Water Management Project, now in process, should give important information as to the best and most profitable use of land in the Philippines. It is hoped, of course, that the pace of diversification in the next four years can be accelerated but any acceleration has to be based on attractive alternatives. The opportunity cost to farmers will be minimized under a policy of greater intensity of cropping with different enterprises. Multiple cropping as a time dimension is what this involves. More can be produced on the same land area. Of course, this clearly implies that this form of diversification is profitable. In any case, there will be an increase in capital, labor inputs and, of course, output The key issue is that a farmer can have his rice and additional products as well under a scheme of multiple cropping. Rice can be followed by such crops as corn, sorghum and soybeans.

Fish also can be produced with rice. As a matter of fact, in a nearby province (Bulacan) water was impounded to form a reservoir. The water was used for irrigation, to raise three tons of fish per hectare, and as drinking water for animals.

Another example of intensification and diversification is rice with ducks. Duck-raising is a profitable industry around Laguna de Bay. After the typhoon season (August to November) feed for ducks becomes a problem because snails, which is the principal feed for ducks, become embedded in mud and sand. Snails become available again in January. During the time when snails are scarce, ducks are brought to feed in newly harvested rice fields and returned to bayside in Janaury (26).

Still another example of diversification is the production of a few hogs and chickens. These enterprises do not compete with rice, and in fact, may be complementary. Rice bran, losses due to shattering, and low quality rice can be effectively utilized by hogs and chickens.

The opportunity cost of diversification becomes high to farmers when they must give up rice land and use it for other purposes. Shifting some rice area to sugarcane, corn, sorghum, soybean, vegetables and/or fruits must clearly show a payoff of considerable relative magnitude. To simply say, for example, that research results clearly show the average farmer will be 10 to 20 percent better off growing soybeans under given conditions is not enough. The differential may need to be much greater because of the risk and uncertainty connected with trying something new. It should never be forgotten that rice means food to rural people. There is a great tradition to produce your own food. Furthermore, with still better varieties, improved irrigation systems, more fertilizer, and a keen awareness among farmers, rice may be the best alternative for many farmers for the next few years even with somewhat lower world prices.

Development Strategy

The Secretary of Agriculture and Natural Resources outlined in a recent address the strategy that will be increasingly employed during the four-year agricultural program period, 1971-1974 (27). The elements follow:

1. Capitalize on new found receptiveness to change brought about by success with rice.

2. Look more and more at agriculture and its separate industries such as rice, corn, and livestock as a total business system.

3. Gear and coordinate all dimensions of agriculture, not simply those relating to production. The coordinating mechanism that now exists in the form of the National Food and Agricultural Council (formely known as RCPCC) is and will be utilized to the fullest extent to push into the areas of feed grains, meat, and fish.

4. Concentrate technical manpower and budget in only a few vital areas as indicated above.

5. New emphasis will be given to socio-economic activities such as land reform, credit, cooperatives, and equity.

The Equity Issue

The essential elements of successful development are: (a) enough food; (b) a job; and (c) equality (28).

In most countries of the world, including the Philippines, development is measured by national income accounts data, particularly the GNP. The GNP, if increasing, does show development potential but in most cases glosses over the problems and provides few answers. If development is really occurring, positive answers must be provided to the following questions (a) Is poverty declining? (b) Is unemployment declining? and (c) Is inequality declining?

If the answers to the above questions are all "no" then there is no real development even if the GNP is increasing. A "plan" which includes no targets for reducing poverty, unemployment and inequality can hardly be considered a development plan (29).

What can be done to reduce poverty, unemployment and inequality in Philippine rural areas? With an average size farm of about 2 hectares what can be done knowing the size of farm will not increase and in fact may decline in the years ahead. As pointed out earlier, agricultural diversification and intensification may play an important role in reducing the gap in income distribution. It should become commonplace in the Philippine that a rice crop be followed by corn or sorghum; that a pond be built for fish production, water and supplemental irrigation; that a livestock enterprise be part of the farm organization, and that some fruits and/or vegetable be produced. Indeed, a few well-managed

highly diversified and intensified farms would demonstrate how much can really be produced on 2 hectares.

A Need for Reform on Agricultural Rice Price Policy

As indicated above, the government through the Rice and Corn Administration, is actively engaged in a program to support the price of rice. Under Republic Act 4643, rice producers are guaranteed a floor price of not less than P16.00 per cavan of palay and the consumer a price ceiling of P1.40 per ganta of rice. The need for price stabilization of rice by the government is deemed very important since rice is a staple food and its production is of a seasonal nature resulting in wide fluctuations of price.

In recent years, the Rice and Corn Administration had incurred huge losses in its buying and selling activities and unless the government is prepared to assume further losses, it is necessary to improve on its present regid price support policy. This agency may continue on its price stabilization function by merely setting the floor and ceiling prices of rice such that the spread just covers the marketing costs and do away with the subsidy allowed to producers and consumers. Perhaps a flexible system of price policy may be set up in which buying and selling prices are made to adjust to changing market or price conditions in place of the present regid pricing structure adopted by the Rice and Corn Administration. It would be highly desirable if the government shifted its price support policy by giving direct benefits to farmers such as providing available irrigation water, fertilizer, and chemicals at low cost in place of the guaranteed buying prices for rice output. Meanwhile, the government should provide adequate appropriations for rice stabilization programs and should institute a uniform standard of unit measure for wholesaling and retailing of this cereal.

CONCLUDING COMMENT

At the recently concluded 27th Session of the ECAFE the head of the Philippine delegation made the following statement· "We called in Singapore, and again in Bangkok, for regional action on the problem of rice ... Since our most dire predictions, made three years ago, have unfortunately come true in the matter of rice, my delegation urges again that action be taken within the soonest possible time lest we continue to betray Asia's farmers into producing more but receiving less... We are prepared to act, to shoulder the full burden of our obligations."(30).

It is the policy of the Philippine government to plan to make the right things happen which includes the identification of the best alternatives for entrepreneurs and hence the promotion of the interests of the general welfare not only in this country but also in countries of the region.

Table. Palay Production (rough rice), harvested area, and yield per hectare, Philippines for crop years 1965-1970

Ending June 30	Production (million cavans*)	Harvested area (Million hectares)	Yield per hectare (Cavans)
1965	90.7	3.2	28.4
1966	92.6	3.1	29.8
1967	93.0	3.1	30.1
1968	103.7	3.3	31.4
1969	101.0	3.3	30.3
1970	118.9	3.1	38.2
1971[a]	120.5	3.1	38.6

Source: Bureau of Agricultural Economics, DANR

* 44 kilograms per cavan

a/Forecast as of January 1, 1971

Appendix Table 1.
Corn: Area Harvested, Philippines
Crop Years 1965-1970

(Hectare)

Year	1st Crop	2nd Crop	3rd Crop	Total
1964-65	828,720	537,300	556,730	1,922,750
1965-66	878,760	574,720	652,600	2,106,080
1966-67	885,950	595,130	676,870	2,157,950
1967-68	918,220	633,560	696,080	2,247,860
	1st Semester	2nd Semester		Total
1968-69	1,248,330	1,007,810		2,256,140
1969-70	1,393,940	1,025,660		2,419,600

Appendix Table 2.
Palay: Area Harvested, Philippines
Crop Years 1965-1970

(Hectare)

Year	Irrigated	Non-Irrigated (Rainfed)	Upland	Total
1964-65	958,380	1,607,030	634,260	3,199,670
1965-66	960,460	1,542,880	605,840	3,109,180
1966-67	1,170,640	1,480,130	445,350	3,096,120
1967-68	1,309,020	1,514,020	480,620	3,303,660
1968-69	1,482,820	1,406,790	442,540	3,332,150
1969-70	1,345,730	1,355,630	412,080	3,113,440

Note: There is no palay planted under deep water.

Appendix Table 3.
Palay: Area Harvested & Irrigated, Philippines
Crop Years 1965-1970

(Hectare)

Year	Total Area Harvested	Irrigated	Per Cent Irrigated
1964-65	3,199,670	958,380	29.95
1965-66	3,109,180	960,460	30.89
1966-67	3,096,120	1,170,640	37.81
1967-68	3,303,660	1,309,020	39.62
1968-69	3,332,150	1,482,820	44.50
1969-70	3,113,440	1,345,730	43.22

SOURCE: Bureau of Agricultural Economics, DANR

Appendix Table 4.
Palay: Area and Per Cent Distribution of High Yielding Varieties, Philippines
Crop Years 1967-1970

(Hectare)

Year	Total Harvested Area	Area Harvested of High Yielding Varieties				Per Cent Distribution (%)
		IR	BPI	C	Total	
1966-67	3,096,120	a/	a/	a/	a/	
1967-68	3,303,660	428,570	254,670	18,260	701,500	21.2
1968-69	3,332,150	899,530	292,580	159,660	1,351,770	40.6
1969-70	3,113,440	1,037,190	114,590	202,150	1,353,930	43.5

a/ Data not available.

Appendix Table 5.
Food Grain Consumption, Philippines 1/
1965-1970

Year	Rice (Milled) a/		Corn (Shelled) b/	
	Sack of 56 kgm	Metric Ton	Sack of 57 kgm.	Metric Ton
1965	48,537,300	2,718,100	19,294,000	1,099,800
1966	50,042,100	2,802,400	19,892,200	1,133,900
1967	51,593,400	2,889,200	20,508,800	1,169,000
1968	53,192,800	2,978,800	21,144,600	1,205,200
1969	54,841,800	3,071,100	21,800,100	1,242,600
1970	56,541,900	3,166,300	22,475,900	1,281,100

a/ Computed at a per capita consumption of 1.544 sacks per year.

b/ Computed at a per capita consumption of 32.0 kilos of shelled corn and 2.984 kilos of shelled corn equivalent of green corn per year

1/ Population is estimated at r = 3.1 per cent annual growth rate based on the preliminary count of 37,008,419 of the 1970 Census on May 9, 1970.

SOURCE: Bureau of Agricultural Economics, DANR.

Appendix Table 6.
Selected Factor and Product Prices
Philippines, 1970-71

Item	Price (Pesos or Percent)
Wholesale average price of palay (rough rice) In Central Luzon, per kilogram [1]	₱0.41
Wholesale average price of rice (Macan, 1st class), Manila, per kilogram [1]	₱0.72
Retail average price of rice (Macan, 1st class), Manila, per kilogram [1]	₱0.88
Daily average wage rate (without meals): [2]	
Plowman with animal	₱4.45 to ₱5.00
Planter	2.65 to 2.95
Weeder	2.40 to 3.05
Sprayer	2.50 to 3.00
Harvester	3.00 to 3.60
Average price per 45-kilogram bag of Ammonium Sulfate, Central Luzon [3]	₱18.50
Institutional credit rate per year	12%
Average land value, Central Luzon, irrigated, per hectare [4]	₱6,000
Typical rental sharing arrangement for tenants (rice)	
Output:	50%
Inputs: Land preparation and weeding	100%
Seed, fertilizer, sacks, harvesting, threshing, hauling, and irrigation fees	50%

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[1] Source: Central Bank of the Philippines

[2] Source: Bureau of Agricultural Economics, DANR. Based on data for first 6 months of 1970.

[3] 21% nitrogen content -- price as of March 1971.

[4] Based on a sale of about 500 hectares to the National Land Authority.

Appendix Table 7.
Rural Banks Loan Activities, Philippines
1966-1970

Loans Granted[1]	1966		1967		1968		1969		September, 1970	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount
Agricultural										
Loans Ordinary	315,595	₱247,485	343,248	₱305,372	363,403	₱355,093	376,870	₱405,943	305,377	₱367,931
IBRD	-	-	1,545	12,947	832	7,724	235	2,586	188	2,337
AGLF	-	-	22,118	16,586	20,699	15,329	8,616	8,312	5,627	5,925
Total Agri. Loans	315,595	₱247,485	366,911	₱334,905	384,934	₱378,146	385,721	₱416,841	311,192	₱376,193
Loans granted for rice	130,280	₱ 92,170	180,520	₱151,377	201,028	₱180,645	188,838	₱188,669	144,931	₱161,177

Loans Outstanding[1]	1966	1967	1968	1969	September, 1970
Agri. (Ordinary)	₱198,604	₱259,393	₱268,946	₱307,911	₱363,132
IBRD	-	-	18,754	17,828	17,510
AGLF	-	-	15,213	16,696	17,617
Past Due	38,678	45,476	58,608	71,477	73,826
Total Loans Outstanding	₱237,282	₱304,870	₱361,523	₱413,913	₱472,087

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[1] Amount in Thousand Pesos.

SOURCE: Department of Rural Banks, Central Bank of the Philippines

FOOTNOTES

(1) Drilon Jr., Jose D. and Goldberg, Ray A., "Notes on the Philippine Rice Industry", Philippine Review of Business and Economics, June 1969, pp. 13-42.

(2) Other important crops grown are as follows: corn for both food and feed is planted on about 2.2 million hectares; coconuts, 1.8 million hectares and sugar cane production, about 350,000 hectares of land. Tobacco is also an important crop and a wide variety of fruits and vegetables also are being produced. Foreign exchange earnings from the export of pineapple run at about $10 million per year and banana exports have expanded greatly in the last two years amounting to $9 million in 1970.

(3) Material Resources Survey, National Economic Council, Philippines, June 1959, p. 24.

(4) Cook, H.E. et. al., Philippine Rice Production and the National Economy: An Analysis of the Situation and Suggested Program, Mimeograph Report, International Cooperative Administration, 1958. A similar finding is reported in M. Mangahas, et. al., "Price and Market Relationships for Rice and Corn in the Philippines," Journal of Farm Economics, XLVIII (August 1966), pp. 685-703. See also R. W. Hooley, Long Term Economic Growth in the Philippines, 1902-1961, a paper presented at a Conference on Growth of Output in the Philippines, IRRI, December 9-10, 1966. For the agricultural sector as a whole, about 51 per cent of the rate of change in agriculture output was accounted for by land input during the period from 1948 to 1960, Lawas, J.M., Output Growth, Technological Change and Employment of Resources in Philippine Agriculture, 1948-1975, Ph.D. Dissertation, Purdue University, January 1968.

(5) The "mean estimate" of rice stock for the months of August and September 1971 gives a 17 and 8 days supply, respectively, Inter-Agency Committee on Rice and Corn Production and Consumption, Second Inter-Agency Committee Report on Rice Outlook of the Country for the Crop Year Ending June 30, 1971, April 14, 1971.

(6) Mears, Leon A., Rice Consumption Characteristics Influencing Rice Marketing in the Philippines, Inst. of Econ. Dev. and Res., School of Economics, U.P. discussion paper No. 7-23, Dec. 1970, p. 41.

(7) Darrah, L.B. and Tiongson, F. A., Agricultural Marketing in the Philippines, U.P., College of Agriculture, 1969, pp. 43-60.

(8) The 5 major typhoons striking within only a few days destroyed approximately ₱604 million worth of agricultural crops and facilities in late 1970.

(9) Four-Year Development Plan, FY 1971-74, Philippines, p. 4.

(10) ____________ National Economic Council, Reexamining the Policy Framework: Agenda for Policy Reforms, March-April 1971 (Preliminary).

(11) Drilon, Jr., Jose D. and Goldberg, Ray A., Op. Cit.

(12) The RCPCC is better known at present as NFAC (National Food and Agriculture Council) with 21 member-agencies as of April 1971.

(13) Efferson, Norman and Sengelmann, Klaus, An Appraisal of Rice Drying, Storage, Processing, and Marketing in the Philippines, the Ford Foundation, Manila, October 1969, pp. 63.

(14) ____________ Philippine Rice Exports in 1970: A Discussion Paper, prepared by Plans and Programs Offic and RCPCC, Philippines, 1970, pp. 10.

(15) Mangahas, Mahar, Estimates of the Task of Rice Price Stabilization in the Philippines, 1969-1974, U.P. Discussion Paper No. 69-9, May 15, 1969.

(16) Business Day, February 10, 1971, Manila.

(17) Efferson, Norman and Sengelmann, Klaus, Op. Cit.

(18) Lawas, Jose M. Agricultural Diversification and Development: The Philippine Viewpoint, paper delivered before Southeast Asia Development Advisory Group, Manila, January 6-8, 1971, pp. 21.

(19) 4-Year Agricultural Development Program, Philippines, June 1, 1970.

(20) The choices among alternative production activities by farmers are influenced not only by customs and habits but also by incentives and opportunities and the risks associated with these opportunities which are brought about by new technologies and/or by new marketing arrangements, Cox, Milo L., Staff Paper on Key Problem Areas -- Agriculture, Agency for International Development, U.S.A., November 1970.

(21) In the past, the National Economic Council, as a national policy determining body, considered maintaining a rice stock lasting from 21 to 60 days supply at any point in time. As indicated in Footnote 5, the present "mean estimates" for rice stock for the months of August and September are respectively below the desired level of rice supply. For this reason, although the expected total production slightly exceed the estimated total consumption of rice, the National Economic Council approved a resolution certifying to an imminent shortage of 110,000 metric tons of rice for the months of August and September 1971 - in order to maintain the considered safe level of rice stock for these months.

(22) Carroll, John J., The Economy Rising Expectations, Limited Fulfillment, Philippine Institutions, Solidaridad Publishing House, Philippines, 1970, pp. 17-39.

(23) Moseman, Albert H., Building Agricultural Research Systems in the Developing Countries, The Agricultural Development Council, Inc., N.Y., N.Y., 1970.

(24) Laudencia, Pedro N. and et. al., Evaluation of Food and Agricultural Research Policies and Programs of the Department of Agriculture and Natural Resources, Philippines, February 1971.

(25) 4-Year Agricultural Development Program, Op. Cit.

(26) Lawas, J.M., Op. Cit.

(27) Tanco, Arturo R. Jr., Address by Secretary of Agriculture and Natural Resources at the Southeast Asia Development Advisory Group, Philippines, January 6-8, 1971.

(28) Seers, Dudley, The Meaning of Development, Agricultural Development Council, Inc., N.Y., N.Y., 1970, pp. 11.

(29) As President Marcos stated, "Economic development is hollow at its core if it does not benefit the greatest number. To frustrate popular expectations in the face of visible material growth is the surest way of defecting that growth." -- Ferdinand E. Marcos, Address by President of the Republic of the Philippines at the opening of the 27th Session, ECAFE, Philippines, April 20-30, 1971.

(30) Tanco, Arturo R. Jr., Country Statement by the Head of the Philippine delegations, 27th Session, ECAFE, Philippines, April 20-30, 1971.

Rice Policy in Malaysia

Abdul Rahman bin Haji Yusof and Ani bin Arope*

Introduction

The object of this Paper is to provide general background on the formulation of national rice policies for Malaysia during sixties as well as those projected to the mid-seventies.

2. Owing to the different nature of the problems and differing economic conditions, a separate rice policy exists for East and West Malaysia. For the purpose of this Paper, a discussion on rice policy for West Malaysia only will be considered relevant, since in 1969/70 86% of rice production is from West Malaysia.

3. Rice policy in Malaysia has three general objectives:-

(i) to reduce dependence upon rice imports;

(ii) to increase incomes of padi growers; and

(iii) to provide high-quality, reasonably - priced rice to consumers.

4. In the 1960-69 period rice production in West Malaysia increased by 3.8% per year. Total consumption appears to have risen by something less than 2.0% annually, implying a decline in per capita consumption as eating habits change with growing urbanization and incomes. Reflecting these developments in local supply and demand, net imports fell from an annual average of 340,000 tons in 1959-61 to 248,000 tons in 1967-69. Most of the growth in local supplies came from increased double-cropping acreage, which rose from 90,000 in 1965 to (preliminary estimate) 310,000 in 1970.

5. Drainage or irrigation schemes completed or now underway will be sufficient to provide rice self-sufficiency in West Malaysia by the early seventies. Table 1 in Appendix 'A' provides a projection of production up to 1975. Yield increases, a small increase in main season acreage and approximate doubling of off-season planted acreage during 1970-75 will maintain self-sufficiency through 1975 and perhaps provide a small exportable surplus estimated at about 80,000 tons.

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Policy Issues

6. Policy issues which evolve from present and expected development in local padi production in general terms fall into four categories:

(i) production targets in rice, and future investment in draining and irrigation;

(ii) income/welfare of padi growers in single-cropped and highly-fragmented areas;

(iii) public assistance for padi sector, including the maintenance of GMP level;

(iv) financial implications of self-sufficiency.

First Policy Issue: Production targets in rice and future investment in drainage and irrigation

7. Although not stated in the First Malaysia Plan document, rice self-sufficiency is frequently held as a policy objective in Malaysia. Thus development programs of the DID and the Department of Agriculture have been geared to that objective. Since self-sufficiency in rice could be attained in West Malaysia by 1972 on the basis of the past and existing continuation program of drainage and irrigation, policy decisions have to be considered regarding long term production objectives in the light of expected world rice prices.

8. Larger world exportable supplies, together with smaller import demands by traditional importers, generated a 30% fall in world prices between mid-1968 and mid-1970 (Thai 5%, FOB Bangkok, May of each year). Knowledgeable sources predict continued weak prices and larger sales volumes at concessional terms as stocks build up in some exporting countries. The World Bank projects export prices per ton for Thai rice to decline from $510 (actual) in 1968 and $414 (estimated) in 1969 to $360 in 1971 with slight improvement in each proceeding year bringing to $375 (FOB) in 1975. With an additional $30 in transport costs, CIF price at Port Swettenham would be about $24.40 per picul for Thai rice. A 20% mark-up between port and retail outlets would result in retail prices for good quality imported rice in 1975 of $24, $29, say $27.

9. Cost estimates by the Department of Agriculture demonstrate that unit costs fall sharply and net returns per acre rise rapidly as yields increase. Where all labour inputs are considered as cash costs and with modest yield assumption for one of the older high-yielding varieties (Ria), a 78% increase in per acre yield (450 to 800 gantangs) results in a 29% fall in unit costs and net returns per acre which are more than four times as high as those realized from the low-yielding variety. It also suggests that a $16 GMP[1] provides a wide margin over production costs when high yields are obtained.

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10. This analysis suggests that the primary means to achieve Malaysia's rice policy objectives of increasing incomes of padi growers is to increase yields in existing acreage. Higher yields are keys to higher producer incomes; the income objectives for producers are not served by the extension of padi production to new areas where yields may be relatively low and unit costs correspondingly high. Higher yields also are essential to any future downward adjustment in the GMP level, an adjustment which is necessary for the competitive export of any future exportable surplus to the world market.

11 Yield increases require continued high priority for research on rice breeding, fertilization, disease control, etc. Also needed are effective extension programs to convey those research results to producers. This reduction in production costs through increases in yields is a primary objective of Malaysia's rice research and extension program. If those requisites are provided, there is good reason to believe that per acre yields on existing acreage can be increased by 2.5 - 3.0% per year. These gains will be sufficient to meet additional consumption requirement each year after self-sufficiency is attained without any need to expand existing padi acreage as population increases.

12. In view of the foregoing, it has been considered necessary that future Government policy emphasis will be altered from an objective of self-sufficiency per se to that of enhanced income and welfare of padi and other farmers, through increased yields on existing acreages, and development of new crop possibilities (e.g. maize and sorghum) which offer maximum possible net returns. Research and extension efforts must also be organized to facilitate expanded production of feed grains (maize and sorghum). Future drainage and irrigation investment under the Second Malaysia Plan other than for continuation and already identified projects will be designed, in such a way as to enable farmers to grow maize, sorghum and other feed grains as off-season crops. No new padi areas will be developed with Government funds under the Second Malaysia Plan, as existing acreage and schemes now underway are projected to provide rice self-sufficiency by 1972.

Second Policy Issue: The income/welfare problems of padi in single-cropped areas

13. In 1970 something less than a third of West Malaysia's padi growers are producing two crops per year. Roughly calculated, annual rice output (and income) of this group appears to be more than twice that of producers who single-crop. By 1975 about two-thirds of all padi acreage will double-crop and account for more than 70% of total output. Output per worker will have increased to more than 2.2 times that of the single-crop producers, with per capita incomes bearing a similar relationship. The typical single-crop farmer in 1975 is likely to have an annual income only about half that of the double-crop producer does, if padi prices weaken, perhaps not much higher than he earns today. An important policy question relates to the income problems of the 100,000-150,000 workers who in 1975 still operate some 346,000 acres of single-crop padi land, either rainfed or irrigated. (See Table I).

Very few of these acres can be converted to double-cropping, although some - perhaps 100,000 of the rainfed areas can be provided with single-crop irrigation facilities. Their income will remain low irrespective of the percentage level of rice self-sufficiency in the country.

TABLE I

Present and Projected Development of Padi Land
(West Malaysia: 000 acres)

	Facilities to Irrigate					
Year	One crop	Two crops	Total	Rainfed	Dry padi	Total padi land
1970	262	310	572	360	57	989
1975	121	662	783	168	57	1,008

14. The income problems of these families are not easy to solve. Several approaches have been suggested:

(i) Measures to increase intensity of land use, e.g. off-season production of crops less demanding of water. This is already practised in some areas. It must be expanded in others. Essential to success of these efforts are strengthened agricultural research, extension and marketing programs.

(ii) Measures to facilitate the movement of workers out of low-productivity padi production into more renumerative activities. This might well be combined with land consolidation programs to provide additional land to farmers who remain. Most of these relocation programs must focus upon younger workers, and include substantial training components. Their success will depend heavily upon the pace of overall economic expansion and the availability of jobs in new land development and outside of agriculture.

15. On the question of market for maize, sorghum and other minor crops, FAMA[2] has proposed a number of marketing improvement schemes for these crops. At present production of maize and sorghum is about 11% of the local requirements for feedmills. The balance is imported duty free. There is therefore a good prospect for expansion in the production of maize and sorghum in West Malaysia, provided it is grown on large scale, feasible and economical for FAMA to develop marketing schemes.

Third Policy Issue: Public assistant for padi sector

16. A third basic policy question relates to the amount of public assistance to be channelled to the padi sector through, e.g. the price support program, input subsidies and public investment in drainage and irrigation facilities. Decisions on these issues imply a careful balancing of economic, welfare and social considerations.

(i) The GMP level

17. A $16 GMP results in high prices for milled rice relative to present and expected world prices. If unit costs of production can be reduced, some reduction in the GMP level may be possible without sacrificing producer income objectives. However, padi "cost of production" is extremely difficult to quantify since it depends upon inherent productivity of the soil, padi variety, management practices, etc. Moreover, it requires evaluation of all resources required in padi production, some of which have no easily-determined values. Given these difficulties, "cost of production" data can at best indicate general orders of magnitude. As stated in paragraph 11, this reduction in production cost must nevertheless be a primary objective of Malaysia's rice research and extension programs.

18. It has been suggested that the very sizeable productivity gains (output/acre/year) from double-cropping and high-yielding varieties will provide net cash incomes for typical producers in the Muda River Project Area of at least twice those realized before double-cropped if the $16 per picul GMP is maintained. However, if GMP is fixed at $14 or $12 their incomes would be reduced by some 20% and 37% respectively. These figures, while necessarily crude, suggest that some reduction in GMP levels might be possible in double-cropped areas without destroying producer incentives or sacrificing important income objectives for padi growers. However, given:

(a) the generally low-income of padi growers vis-a-vis others; and

(b) that only about one quarter of the total padi area in West Malaysia is now double-cropped (rising to more than half by 1975),

it has been decided that the GMP program be continued under the Second Malaysia Plan, and that its present level of $16 be retained subject to annual review.

Government purchase points

19. Efforts will also be made to make the GMP effective to more farmers by e.g. increasing the number of Government purchase points and improved grading. At present the Ministry of Commerce and Industry operates the GMP system indirectly through the purchase of rice (rather than padi) for stockpile purposes from private millers and the Padi and Rice Marketing Board (PRMB)[3/]. In rare cases the Ministry dispatches mobile padi purchasing teams to buy

padi at farm level. As a result, direct purchase of padi for stockpile purposes is minimal. In contrast, in areas where PRMB have trading schemes (Tanjong Karang/Sabak Bernam and Kedah/Perlis) the PRMB implements the GMP more effectively by having purchasing agents at farm level. It is essential that Government increases its direct purchase of padi at farm level by establishing more purchase points and/or extending the areas covered by its mobile padi purchasing teams.

Grading and Standards

20. The existing Malaysian Padi grading system by visual means does not encourage production of high-quality padi. It operates to the disadvantage of farmers who grow high-quality padi. Price supports must be geared more closely to padi quality; good padi should be recognized as such through a grading system more refined than than that currently in use. Farmers who purchase high-quality padi should be rewarded by a pricing system which reflects quality differences. Thus the grading system initiated by the Standards Institution of Malaysia and developed by the Division of Food Technology will be adopted and employed in Malaysia as soon as possible.

(ii) Subsidies and Credits

21. Subsidization of inputs -- water, seeds, herbicides, fertilizers,-- has been an important means of assisting padi growers. The padi fertilizer subsidy was initiated in 1961 and has been continued at rates ranging from 10% to 15% of the retail price. It now stands at 30% of the per acre value of all recommended fertilizer and other agricultural chemicals and is available to padi growers with 5 acres or less of padi. Estimated total cost per acre is $12. Fertilizer distributed under the scheme rose from 2,700 tons in 1960 to 25,500 tons in 1967. A few farmers buy fertilizer outside scheme provisions and pay commercial prices; some do not use fertilizer. The area fertilized in 1970 is estimated to be 300,000 acres, or about 30% of the total area under wet padi.

22. It has been proposed that the padi fertilizer subsidy be discontinued after 1970 except for padi cultivation in non-irrigated areas. The Padi Subsidy Scheme will have as its target the granting of subsidy to about 100,000 acres of non-ratable padi areas at a rate of 20,000 acres per year.

Fourth Issue: Financial implications of self-sufficiency

(i) The present mechanism

23. At present some of the costs of the GMP program (Government rice stockpile) are met through the rice trading and import licensing activities of the Ministry of Commerce and Industry. The Ministry guarantees to buy all locally-produced padi offered to it at the GMP (at mill door) or milled local rice from millers at a price based on the GMP, provided millers certify that they have paid at least the GMP for the padi. This relatively high-priced rice

acquired by the Ministry is sold to importers with some mark-up as a precondition to obtaining an import license. Because the Ministry's selling price generally exceeds free market prices for rice of similar quality, the private dealer/importer can dispose of local rice only at a loss. This loss by private dealers is covered through the mark-up on imports of high-quality, relatively low-priced (CIF basis) rice. Obviously, the revenue derived from the Ministry's trading activities coupled with rice imports will not be forthcoming when self-sufficiency is achieved.

24. In recent years the cost of the GMP operations have in fact been low because free market prices for rice have been above the price support level. Purchases by the Government stockpile have been relatively small -- in some years virtually zero -- and limited largely to rice on a grade lower than Kedah No. 1. Expanding domestic production and falling world market prices will exert a downward pressure on farm and wholesale prices. Without careful control of imports, prices may decline, thereby requiring more effective price support operations and larger purchase in buffer stock operations.

(ii) Future costs of price support and strategic reserve programs

25. The role of Government's padi/rice stockpile is two fold: firstly, as a depository for the padi or rice acquired by the Supplies Division of the Ministry of Commerce and Industry through its price support program and secondly, as a strategic food reserve to protect against disruption of imported and/or local rice supplies. The strategic food reserve role largely benefits consumers; its cost should not be considered as part of the cost of maintaining a price support program for producers. For purposes of analysis and administration, these two roles must be clearly distinguished.

(a) Costs of the strategic rice reserve

26. The annual costs of maintaining a rice stock as a strategic food reserve include (1) capital charges on funds tied up in rice stocks; (2) capital charges on warehouses facilities; and (3) administrative and other costs associated with rice storage and handling. In 1965-67, administrative and operating expenses of about $20 were incurred on the average each time a ton of rice was purchased or sold in stock pile operations. An annual rental charge of about $6.40 per ton of storage capacity was paid by Government for privately-owned space rented for stockpile storage: this can be taken as a rough measure of annual per ton warehouse costs in stockpile operations. With the stockpile purchase price of e.g. $460 per ton ($27.50 per picul) of milled rice and an annual opportunity interest rate of 10%, annual capital charges per ton held in the reserve would be $46. Thus, with the assumption that each ton of stockpile rice is "turned over" once each year (bought and sold), total annual cost of maintaining a ton of rice in the Government stockpile is about $92.40 (i.e. $20 purchase + $20 sale + $6.40 storage charge + $46 capital charge).

27. A strategic reserve is most necessary when:

(1) consumption requirements must be met in part through sizeable imports;

(2) local production is very uncertain due to natural hazards.

A strategic reserve is also more valuable when local supplies derive largely from single-cropping, since harvests are 12 months apart instead of only 6 as with double-cropping. These factors are changing rapidly in West Malaysia. Self-sufficiency in West Malaysia appears imminent, with the off-season crops accounting for an even larger proportion of total production. Improved water control through drainage and irrigation schemes will greatly reduce drought and flood risks in important padi-growing areas. And the future world rice market is likely to be characterized by abundant supplies and lower prices. For these several reasons, a strategic reserve target based on circumstances of the past is likely to be excessive. (Buffer stock operations in price support implementation will of course continue but should be clearly distinguished from strategic considerations). Hence, it is considered that Government should reduce its strategic reserve requirements, taking into account both cost and non-economic considerations, to one month's consumption requirements of West Malaysia's non-padi growing population. This reserve requirement is solely to safeguard against possible shortage due to flood, drought, crop failure or even unforseen war. Funds required for the purchase of rice would therefore be reduced.

(b) Costs of financing of the price support program

28. At present the current price support program by the manipulation of the Government rice stockpile entails little direct cost to the Government, except for salaries of Government servants, since program costs have in fact been charged to consumers of imported rice. As stated in paragraph 24, self-sufficiency precludes this means of finance. The cost of price support program as soon as 100% self-sufficiency is reached some time in 1972 as projected in Appendix A, will, like the strategic rice reserve, consist of capital charges on the revolving funds, storage and administrative costs and is also estimated to be at $92.40 per ton. The scale of the support program will depend upon a number of factors. At one extreme is a situation where with careful control of low-priced imports and smuggling and with a legal requirement that licensed millers or wholesalers purchase padi at GMP price equivalent, then in theory the price support program consists of the administrative costs of supervision and enforcement only. However, in practice this system may not be effective because, while it is possible to control the price at which millers and wholesalers purchase, it is impossible to control the quantities to be purchased by them. With full self-sufficiency, there will be equilibrium in production and consumption during the year; but in the short-run, there will be disequilibrium because supply of padi is seasonal thus resulting in seasonal surplus of padi as well as rice, all of which the millers and wholesalers respectively cannot be forced to buy. Thus, under these circumstances, there is still need for physical stockpile to cater for seasonal surplus for both padi and rice.

29. At present any padi surplus is absorbed by private millers and FAMA's Padi and Rice Marketing Board. The millers pass on the surplus in the form

of rice to the Government Stockpile. With self-sufficiency, the surplus of padi will be greater and where is no assurance that millers will have the capacity to absorb the additional supply. Given sufficient time, and assurance that they could dispose of their rice milled from the surplus padi, millers may increase their capacity, and on this assumption, there appears that the need for the Government Stockpile to operate at the farm level through the Government Stockpile may not be greater than it is at present though the Padi and Rice Marketing Board may increase its purchase of padi at farm level. The Government Stockpile will, nevertheless, still be required to purchase the surplus of rice offered by millers and the Padi and Rice Marketing Board (in cases where the Board also mills its Padi). The amount of this purchase will depend largely upon the willingness and storage capacity of wholesalers to purchase rice from the millers and the Board more than their immediate requirements. Thus, exact amount of revolving funds required for the price support program to cater for seasonal surplus during a peak period is difficult to establish. For illustration, if all West Malaysia production is supported at $16 which is roughly consistent with a stockpile purchase price of $27.50 per picul of milled rice and if, the peak period surplus in 1972 is 257,000 tons, then the amount of revolving funds needed to finance the stockpile purchase during the peak period of only one month will be about $118 million at its maximum. The amount of surplus will taper off until the beginning of the next harvest. The cycle will repeat itself. Program administration, storage, and interest costs, whenever applicable, will be additional, amounting to about $21.5 million per annum. It is fair to assume that rice wholesalers will also carry stocks of rice beyond their immediate sale requirements, and that being the case, the need for revolving funds will be accordingly reduced.

(c) Costs to FAMA in Price Support Program

30. FAMA's Padi and Rice Marketing Board, in addition to the Ministry of Commerce and Industry, also implements the price support program. It does so more effectively by purchaging padi at farm level, whereas the Ministry of Commerce and Industry purchases milled rice from millers. In 1970, the amount of revolving funds used to implement the price support program was about $13.3 million. By 1972, the amount of revolving funds available to FAMA will be $28.4 million. This will enable it to purchase some 106,000 tons of padi per season. FAMA, however, proposes to revolve the funds twice a year in double cropped areas so that the total padi purchased during the year will be 212,000 tons. This also means that operating costs will increase by about 50% from $73.28¢ per turn over per ton to $113.28¢. The total operating costs are estimated at $12 million.

(d) Costs of Export Subsidy

31. Beginning from 1972, West Malaysia will produce more rice than its requirements. Appendix A projects that the annual surplus will steadily increase to 80,000 tons by 1975. This means that unless the annual net surplus is disposed of, an accumulated total of 142,000 tons is stocked by the end of 1975. Funds for the purchase of this annual surplus will be additional to those revolving funds required for seasonal surplus.

32. One possibility of disposing the net annual surplus is to ship it to East Malaysia where self-sufficiency is less imminent. In recent years, rice imports into East Malaysia provided about 40% of consumption requirements in these two States. In 1966-69, imports into Sabah average 30,000 tons annually and Sarawak ranged between 45,000 to 61,000 tons per year. Thailand and China have been the major rice suppliers to both States.

33. The attractiveness of the proposal to ship surplus rice to East Malaysia depends largely upon prices at which this rice can be made available. A $16 GMP for local padi is roughly consistent with an FOB, wholesale or stockpile purchase price of $27.50 per picul of milled rice and a retail price of about $34. This price of $47.50 ($460 per ton), FOB basis, can be compared with the projected 1975 FOB price for Burmese rice of $300 or $375 for good quality Thai rice. Assuming quality of Malaysian rice is roughly identical to either Thai or Burmese rice, these figures suggest that subsidies of M$85-$160 per ton would be required in 1972-1975, to move Malaysian rice into world markets if the $16 GMP is maintained. Other things being equal, a lower GMP would require a lower subsidy. To the FOB price of about $460 per ton must be added costs of transport between Port Swettenham (the port serving West Malaysia's largest rice surplus area) and East Malaysian ports of about $50 per ton. This CIF price (Kuching/Kota Kinabalu) in excess of $500 per ton can be compared with the projected CIF price for Burmese or Thai rice of $350 or $425, respectively. A subsidy of $75 to $150 per ton would appear necessary to provide competitively - priced West Malaysian rice in East Malaysia. The level of subsidy is however comparable with the annual cost of maintaining a ton of rice in the Government Stockpile (which is at $92.40 per ton, see paragraph 27). If East Malaysian imports totalled about 80,000 tons annually, as in 1966-69, and all come from West Malaysia, the yearly export subsidy bill would be between $6 to $12 million. This assumes that there are no protective tariffs against foreign rice in East Malaysia. With such tariffs being introduced, the amount of subsidy will be smaller.

34. The above discussion indicate in general some of the policy issues which provide the basis for the formulation of rice policies for Malaysia during the sixties and up to the mid-seventies.

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APPENDIX A

WEST MALAYSIA: PROJECTION OF DEMAND, SUPPLY AND IMPORTS OF RICE - 1963 - 1975

Year	Population (thousands)	Annual Consumption per capita (lbs. of rice)	West Malaysian rice requirement ('000 tons of rice)	PADI - MAIN CROP									Off-Season			Dry Padi			Total			Necessary Imports (Net) ('000 tons of rice)	% Self sufficiency
				Irrigated Area			Non-Irrigated Area			Total Area													
				Acreage/1	Yield (lbs. of rice)	Prod. (tons of rice)	Acreage	Yield (lbs. of rice)	Prod. (tons of rice)	Acreage	Yield (lbs. of rice)	Prod. (tons of rice)	Acreage	Yield (lbs. of rice)	Prod. (tons of rice)	Acreage	Yield (lbs. of rice)	Prod. (tons of rice)	Acreage	Yield (lbs. of rice)	Prod. (tons of rice)		
1963	7,611	304	1,033	311,332	1,515	210,566	574,838	1,489	382,074	886,170	1,436	592,580	49,110	1,587	34,840	55,450	819	20,310	990,730	1,463	647,730	389.2 /2	62.7
1964	7,814	284	991	314,976	1,449	203,750	564,914	1,305	329,010	879,890	1,354	532,760	58,420	1,558	40,650	52,340	775	18,150	990,650	1,336	591,560	401.8 /2	59.7
1965	8,039	260	933	317,073	1,518	214,874	579,627	1,469	380,016	896,700	1,485	594,890	89,840	1,647	65,380	53,440	717	17,120	1,039,980	1,460	677,390	257.3 /2	72.6
1966	8,298	251	930	322,289	1,535	220,854	573,771	1,375	352,266	896,060	1,431	573,120	104,450	1,660	77,410	52,870	692	16,370	1,053,380	1,416	666,900	270.6 /2	71.7
1967	8,540	249	949	338,575	1,484	224,306	540,335	1,279	308,634	878,910	1,358	532,940	156,940	1,594	111,860	51,500	622	14,310	1,087,350	1,358	659,110	285.9 /2	69.5
1968	8,789	259	1,018	511,870	1,635	373,619	394,720	1,274	224,511	906,590	1,478	598,130	224,660	1,656	166,080	51,790	688	15,790	1,182,500	1,472	780,000	238.5 /2	76.6
1969	9,035	256	1,031	546,000	1,737	423,394	399,970	1,343	239,866	945,970	1,569	663,260	238,130	1,751	186,330	57,180	677	17,250	1,241,280	1,562	866,840	220.3 /2	84.1
1970	9,288	260	1,078	572,000	1,702	434,536	366,000	1,350	216,964	938,000	1,556	651,500	310,000	1,769	244,817	57,600	692	17,600	1,305,000	1,569	913,917	164.1	84.8
1971	9,548	260	1,108	606,810	1,787	484,094	339,190	1,350	204,423	946,000	1,630	688,517	420,000	1,787	335,062	57,000	692	17,600	1,423,000	1,621	1,041,179	66.8	94.0
1972	9,815	260	1,139	673,023	1,805	542,324	275,977	1,350	166,928	950,000	1,672	709,252	350,000	1,805	427,076	57,000	692	17,500	1,537,000	1,682	1,153,928	-14.9	101.3
1973	10,090	260	1,171	723,227	1,823	588,590	226,773	1,350	136,671	950,000	1,710	725,261	560,000	1,823	455,750	57,000	629	17,600	1,567,000	1,713	1,198,611	-27.6	102.4
1974	10,372	260	1,204	756,204	1,841	621,505	193,796	1,350	116,797	950,000	1,741	738,302	570,000	1,841	468,469	57,000	692	17,600	1,577,000	1,739	1,224,371	-20.4	101.7
1975	10,663	260	1,238	782,793	1,859	649,640	167,217	1,350	100,778	950,000	1,769	750,418	662,000	1,859	549,401	57,000	629	17,600	1,669,000	1,768	1,317,419	-79.4	106.4

1963 - 1969 Actual figures - including actual figures for 1970 main season.

1970 - 1975 Projected figures.

/1 Obtained from D.I.D.

/2 Actual net imports.

3.64 lbs. of rice - 1 gtg. padi

FOOTNOTES

1/ Guaranteed Minimum Price for padi, introduced in 1949.

2/ Federal Agricultural Marketing Authority established by an Act of Parliament in 1965.

3/ Padi and Rice Marketing Board established in 1967 through Regulations derived from the FAMA Act 1965.

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Rice Policy in Indonesia

Saleh Afiff and C. Peter Timmer[*]

I. Evolution of the Policy: 1950-1967

Most wajang golek, the traditional and popular Indonesian puppet plays, have three acts. The first introduces the characters and identifies good and evil. The second casts the good characters, usually because of some minor flaw in their character, into great tragedy and causes the audience to nearly lose hope. But in the third act the hero, after many narrow escapes and temporary reversals, manages to emerge triumphant and banishes the evil forces to the forests in East Java. Whether is is art following life, or vice versa, many events in Indonesia seem to have a tendency to follow this heroic pattern. And the "rice problem" is no exception. In order to understand the present policies and what looks like an emerging success story, it is necessary to see acts one and two.

Historical Perspective

Tables A-1 - A-5 at the end of this paper present an historical and statistical summary of the role of rice in Indonesia. The overriding importance of rice as the basic Indonesian foodstuff is clearly reflected in Table A-1, which compares the per capita production of the basic carbohydrates -- milled rice, maize, cassava, and sweet potatoes -- on a milled rice equivalent basis. In only one year did rice fall below half the total carbohydrate production. And production data alone understate the importance of rice consumption because rice is imported while cassava (tapioca) and maize are exported. In 1960, for instance, about 1.1 kg. per capita of tapioca was exported and 9.3 kg. per capita of milled rice was imported. So although rice formed 55% of Indonesian carbohydrate production in 1960, it was 58% of carbohydrate consumption. In fact, the mere fact that rice is imported while other basic carbohydrates are exported indicates how important rice is for the population.

For the five years from 1960 to 1964 rice imports averaged a million tons. In 1965 and 1966 when imports were less than a quarter of a million tons, rice consumption was only 80 kg. per capita, 11% below the 1960-64 average. A further notion of the "rice problem" faced by the present government when it came to power in 1966 is evidenced in Table A-1. The production of rice as a percentage of total carbohydrate production declined fairly steadily from the 1960 level of 55.1% to a low of only 47.9% in 1964. In 1966 the level was still but 52.9%.

Table A-2, which shows total rice production, area harvested, and yield for Java, outside Java, and all Indonesia, gives an even clearer picture of the problem. Throughout the 1950's and early 1960's, rice production outside Java was erratic, but around a rising trend. The 1966/67 average of 4,275 million tons was 23.2% higher than the 1959/60 average of 3,470 million tons.

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But production on Java, where approximately 80% of Indonesians live, actually declined by 4.6% during the same time period. This decline, from 5.055 million tons to 4.820 million tons occured in the face of a population increase of about 17%. The situation is even worse if particular years are picked out to magnify the decline: from 1960 to 1964 production fell by 13.6% on Java.

The factors responsible for this decline, mostly the political and economic instability that will be discussed shortly, took a heavy toll in rice production. If only the rather modest trends of the late 1950's could have been maintained on Java, an increase of 1.5% per year in production, output in 1966/67 would have been 5.61 million tons instead of 4.82 million tons, or 16.4% higher than what was actually realized.

The production problems on Java in the early 1960's were jointly caused by declining area harvested and declining yields. Yields dropped continuously from a 1962 high of 1.26 tons of milled rice per hectare to a 1966 low of only 1.13 tons per hectare, which was no better than in 1958. Compounding the problem of lower yields, and partly causing them, was a prior decline in area harvested. This was mostly due to a deterioration, through neglect and lack of funds in the rather sophisticated irrigation network on Java. As the extent of technical irrigation declined, so did the area successfully double cropped. Inadequate and uncertain water supplies also led to lower yields.

The economic instability probably caused some decline in production even more directly. The extent of the price instability, which is now infamous, is shown in Table A-4 and Table 1. Rice prices rose from an average of 6.59 Rp/kg in 1957/60 to 2816.35 Rp/kg in 1965, and prices had reached 8000 Rp/kg in 1966 before the 1000 to 1 deflation. Farmers who sold their production at harvest time were unable to buy their essential living commodities a month later. Of course, even day to day credit tends to disappear in such an inflation.

Table 1: Average Prices of Medium Quality Rice
in Djakarta, in Rp/kg.

Year	Price	Year	Price	Year	Price
1950	0.85	1957	5.01	1964	211.64
1951	2.06	1958	7.30	1965	2816.35
1952	2.26	1959	6.46	1966	7.12*
1953	2.25	1960	7.60	1967	19.80*
1954	2.83	1961	13.45	1968	62.72*
1955	3.05	1962	42.04	1969	42.08*
1956	3.93	1963	78.91	1970	48.14*

*New rupiahs, equal to 1000 old rupiahs.

Source: BULOG

But Table A-4 shows that the general inflation was only part of the instability that plagued the farmer. The other part, and probably even more important in terms of a disincentive to production, was the extreme movements in rice prices (both up and down) seasonally and spatially. Table A-4 does no more than provide a glimpse of the gyrations, but even this is astonishing.

In February, 1962, rice prices in all Indonesia averaged about 39 Rp/kg. But the price in Bali was only 13.25 Rp/kg at the same time the price in Palembang, in Sumatra, was 80.00 Rp/kg. Physical transportation and handling costs would not have exceeded 10 Rp/kg to move rice from Bali to Palembang. By October, 1962, the pattern of prices had changed drastically with the Bali price rising seasonally to 48.00 Rp/kg (!) while the Palembang price fell to 60.31 Rp/kg. But the very wide degree of price deviation nationally, measured simply as the sum of the percentages that the individual high and low prices are from the average, was hardly changed. In February this sum was 171.3% and in May it was 169.7%. The average for 1962, based on the three representative months of February (high price on Java), May (low, harvest price on Java) and October (about average), was 148.3%. This typically meant that the highest price prevailing in Indonesia was about 4 times the level of the lowest price. And this range is not a lowest farmgate price to a highest urban retail price; it is a comparison of urban retail prices.

The situation in 1966 was essentially the same, with an average sum of deviations for the year of 112.1%, down somewhat from the 148.3% of 1962. But the rice market in particular and the entire Indonesian economy in general were still characterized by an inability to match seasonal and regional price differences to the costs of storage and transportation. At fault were all the factors common to all underdeveloped market economies -- shortage of credit, lack of communication and information, inadequate marketing facilities (especially on the outer islands), etc., and these were accentuated in Indonesia by the rapid inflation and deteriorating infrastructure.

But in addition, and probably more important, the fault lay with governmental barriers to trade. The national government prevented rice mills from operating except on government account. Regional administrators, fearing (with some cause) that the national government would not provide adequate rice in case of shortage, prohibited the export of rice from their region, no matter how low the price fell. And at all levels almost everyone with any type of authority found the rice trade an easy source of revenue, so that taxes, both formal and informal, frequently exceeded the value of the rice traded. Rice policy, such as it was, emphasized consumer interests (rice imports from 1960 to 1964 averaged a million tons a year -- see Table A-3) and local revenue generation. It is no wonder that production suffered and prices were unstable.

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Repelita: the First Five-Year Development Plan (1969/70-1973/74)

When work on the Five-Year Plan began in 1968 the new government had already achieved a substantial degree of monetary stability, at least relative to the previous few years. Through a combination of very high official interest rates (9% per month) and imports of food aid commodities (the rupiah proceeds of which were used, instead of the printing press, to finance the government budget), the inflation rate was brought down to 30%-40% per year. Stabilization was still the primary goal of the government, but attention was being turned to development.

It was inevitable that rice, because of its paramount importance in the national economy, would be called upon to play a dual role. Because it was the chief wage good in the economy [1] and has a 31% weight in the Cost of Living Index, rice prices would have to be stable if the economy was to be stable. And because rice production and processing was the chief source of livelihood for about half the Indonesian population, production would have to increase if there was to be any widespread increase in incomes per capita. And finally, because of the new, high yielding rice varieties (developed partly from Indonesian rice strains), Indonesia's comparative advantage, at least in the short-run, lay in agriculture. The most lucrative import substituting investments were likely to be in rice production. Self-sufficiency in the basic foodstuff became the leading priority of Repelita /20 , p.3/

It is the nature of the planning process that general goals such as self-sufficiency get translated into specific production targets. It is slightly ironic that with possible targets determinable by the requirements of stabilization, income growth, or foreign exchange savings, that the ultimate rice production target in Repelita is nutritional. Production of 15.42 million tons in 1973/74, the final year of Repelita, will guarantee a per capita consumption of 120 kg of rice. This quantity was recommended as necessary on nutritional grounds at a "Workshop on Food" sponsored by The National Academy of Sciences and LIPI, the Indonesian equivalent, in 1968.

The general strategy for agriculture is best stated in Repelita itself:

> "The present Five-Year Development Plan for the agricultural sector aims at increasing food production, especially rice, increasing the production and diversification of export crops, and enlarging employment opportunities. With

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[1] Leon Mears calculated /10 , p.6/ in 1967 that a 5 Rp/kg. increase in rice prices, then about 15-20 Rp/kg., would lead to an increase in rubber production costs on estates of 5.5%.

> increased productivity the agricultural sector will form an expanding market for the output of other sectors, especially the industrial sector, which will increase the possibilities of accumulating capital to finance the development of other sectors.
>
> "Production of food will be increased at a rate that will permit within the next 5 years the elimination of rice imports. A supplementary aim is to improve the nutritional value of the consumption of the average Indonesian through increasing the production of foodstuffs which contain animal as well as plant protein, especially fish, nuts and beans. The positive effect of achieving the above objectives is that Indonesia will not have to import rice, which means that scarce foreign exchange can be used to import the capital goods and raw materials needed for the development of other sectors, especially the industrial sector. Moreover, increasing the production of food will result in raising the income of the food producers. This will improve the standard of living of the farmers who for such a long time have lived in poverty and misery." /20, pp. 4-5/

It is essential for an understanding of Indonesian rice policy to realize that Repelita presents only one side of the picture -- the development side. The other side, which is necessary even before any development can take place, is price stabilization and market integration. Stabilization, once achieved, tends to be taken for granted. But in Indonesia, only five years away from an inflation rate of 600% a year, stabilization is still a cornerstone of the rice policy. Development is building on that cornerstone and, probably, will eventually obscure it. But without it the whole effort crumbles.

II. Implementation of the Policy, 1968-71

Any rice policy must have an impact on all three facets of the market -- supply, demand, and price. Some policies tend to emphasize one rather than other, but in the end each is mutually determined with the others. In Indonesia, the policy target is consumption oriented, the implementation through the BIMAS rice intensification program is production oriented, but the ultimate evaluation of the policy is determined by the level and stability of prices and the level of imports.

In discussing the details and implementation of the policy, then, it is helpful to look at supply, demand, and prices separately, realizing all along that they are not separable. The discussion of prices especially will draw on the results in production and consumption.

Production

Attempts to raise rice production pre-date World War II. The Dutch colonial government tried to reach the peasant cultivator with an extension service system known as the "oil spot" (olie vlek) method. The idea was to demonstrate means of increasing productivity on locations with the best conditions to ensure success of the technique. The successful application of a particular way of cultivation could then be copied by farmers in an ever widening area.

The demonstration plots were generally only one-third of a hectare, and while the qualitative results were quite satisfactory, progress was much too slow to even keep pace with population growth /25 , p.4/. After Independence, attempts were made to shorten the time span through a more effective extension service. But the result was merely an enlargement of the "oil spot" technique which foundered through lack of funds.

In 1959 Indonesia embarked on an ambitious three year self-sufficiency-in-rice campaign. Three separate programs were initiated :

1) intensification of rice cultivation through the use of "padi centers",
2) rice cultivation on dry farms through mechanical clearing of land, and
3) clearing and cultivation of tidal lands.

Only the first program was started in 1959. Each padi center was to coordinate the intensification efforts over an area of approximately 1000 hectares; after five years the plan was to have 1,500,000 hectares in the program. Farmers in each padi center area were given credit in the form of fertilizer, seeds and funds, with repayment in the form of dry stalk padi, generally at a price below free market prices /25 , p.7/.

The padi centers centralized, for the first time, all of the tasks of rice intensification. These included the provision of education, information, fertilizer and pesticides, and a means of collecting the padi as payment. But the program was a failure. In 1959 Indonesia imported 610,000 tons of rice and in 1962 it imported 1,010,000 tons. The sources of the failure /25 , p.8/ were important lessons in the design of current programs:

1) The strong centralization of the intensification effort in general, and the padi collection at low prices in particular, met with an unfavorable response from the farmers. Not unnaturally, they regarded it as the government practicing the usurious *idjon* system. /25, p. 9/

2) Easy credit, designed to bypass bureaucratic bank procedures, was badly abused, both by the officers giving the credit and by the farmers receiving it.

3) The new agency was given, "in one stroke", responsibility for disseminating information, distributing fertilizers, supplying seeds, disbursing credit, and collecting padi. Consequently, each padi center was extremely short of experienced and trained personnel, although in many cases these personnel were available and unutilized in existing specialized agencies.

The failure of this apparently well conceived program meant that any program to follow must be small in scale and independent of Government support. Thus, the BIMAS "action research" program, conceived in 1963 at the Institute of Agriculture in Bogor, sent twelve fourth and fifth year students to live in the villages and work closely with three blocks of about 50 farmers each. The results were rice production 50% higher than on neighboring fields /23 , pp.63-64/.

There were two basic innovations in the program that earlier efforts lacked: the extension "agents" lived in the villages alongside the farmers, and each worked only with a limited number of farmers whose fields lay next to each other.

> "These two innovations made the difference between success and failure. As has been mentioned, the students were neither skilled rice technologists nor experienced extension agents, but they were young and enthusiastic and, living in the village as they did, soon won the confidence of the farmers. A part of their task, moreover was to conduct demonstration-type fertilizer and other experiments on farm fields, and the joint work they did with the farmers on these experiments helped them to gain the respect of the experienced practical agriculturalists. In-

> sistence that no single student should work with more than 50 farmers whose fields lay in one block of land also meant that the students could get to know the farmer co-operators well. It meant, too, that the program was not "diluted" as had happened all too often in the past when extension efforts were ineffective because they were spread too thin. An important by-product of working with a group of neighbors was that it helped the students to organize joint or communal activities, for example cleaning the irrigation channels, that benefited the whole group." /23 , p.64/

The program was so successful in 1963/64 that it was expanded in 1964/65 to 440 students from nine colleges of agriculture sent to 220 villages. This year the program was sponsored and financed by the Dept. of Agriculture rather than the college to give the effort more authority. About 10,000 hectares were covered by this program, with yields almost 5 metric tons of dry stalk padi higher than non-program yields.

The success of this program, which developed as its slogan pantja-usaha[2], was as much due to the brashness and courage of the student workers as to the techniques being introduced. Difficulties in obtaining supplies, especially fertilizer, were severe, and the student actions often drastic.

"Two of the groups of students were able to obtain the fertilizer only after making special return visits to the provincial capital where they interceded with the Provincial Governor and the Provincial Head of the Department of Agriculture on behalf of the farmers." /23 , p.65/ The reception of the farmers to the program was excellent so long as the supplies were actually available when needed.

But once again a successful idea was expanded too rapidly. By 1967/68 total area under the program reached almost 1.6 million hectares, and the yield differential was only 2.1 tons of stalk padi higher than non-program yields. The inverse relationship between program area and differential yields has been identified by the BIMAS evaluation study and can be summarized as follows :

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[2] Pantja-usaha is "the five-fold way", and included 1) improved water control, 2) use of improved seed, 3) use of fertilizer, 4) use of pesticides, and 5) better cultivation methods /23 , p.66/

Table 2: Relationship between Program Area and Differential Yield over Non-Program Yields

Year	Program Area	Program Yield	Non-Program Yield	Differential
	(Ha)	(..Ton/Ha	mill dry stalk	padi....)
1965	9,800	7,290	2,313	4,977
1966	340,600	4,910	2,216	2,694
1967	522,000	4,890	2,123	2,767
1968	1,596,200	4,038	1,905	2,133
1969	2,258,700	3,243	2,258	0,985
1970	1,748,600	4,319	2,328	1,991

SOURCE: Rice Intensification Study, Economics Group, Appendix 4, "Imputed Contribution of the Government Intensification Program to Indonesian Rice Production", Preliminary Draft.

The declining program yields and diminished yield differential as well as concerns for fertilizer supplies and credit availability, induced the Government to attempt still another approach for the harvest in 1969. This was the BIMAS Gotong Rojong (BGR) program, under which the Indonesian Government contracted with several foreign companies to provide rice areas with fertilizers and pesticides to increase yields. The contractors also agreed to deliver seed and cash allowances to the farmers and to provide equipment and advice to the extension workers.

The contract[illegible]s covered mostly suppliers credits, for the companies used fertilizer and pesticides of their own manufacture. These credits, plus a substantial management fee, were repaid generally within one year of application. The Central Bank paid the foreign companies a fixed price per hectare treated. The farmers who were placed under the program were then obligated to deliver one sixth of their total padi crop to the government in exchange for the inputs and services received from the foreign countries. At the same time the Government continued some of its previous intensification programs, so that total area under some sort of program in 1969 reached two and a quarter million hectares.2a/

Relative to what had been achieved under earlier programs, and relative to the availability of most production inputs

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2a/ This is a simplified summary of a very involved topic.

on soft-loan terms, BGR was a production and financial failure. The quantity of padi received from the farmers by BULOG as repayment of the credit was substantially below expectations. The shortcomings had to be drawn from budget revenues to enable payment by the Central Bank to the contractors, and this was a serious drain on resources.

It has been difficult to determine exactly why there were such large shortfalls in padi repayments. But both lower yields than anticipated (see Table 2) and underpayment of actual yields seem to have been responsible.

Further difficulties with BGR were 1) locating the program in some areas where adequate water supplies were not assured thus wasting a portion of the inputs, 2) the rigid package of inputs caused many farmers to sell part of the fertilizer on the market at cut-rates, with the buyers frequently using the fertilizer on non-rice crops, and perhaps most important in its longer run impact, 3) the BGR program had a very negative effect on the development of a market structure and credit institutions The program bypassed the existing commercial traders who utilized primarily the civil administration and foreign contractor in servicing the farmers in rural areas. Farmers also became accustomed to not repaying credits.

In a remarkable show of flexibility, the Government discarded the entire BGR program in 1970 after carefully evaluating the evidence. In its place, building on the foundations of the earlier BIMAS programs and a very successful 75,000 hectare pilot scheme in Jogjakarta, was a "perfected BIMAS" organized around a "Village Unit". This program, which now looks as if it will carry the major thrust of the rice intensification effort through the end of the Five Year Plan (1973/74), can be quickly summarized as being "incentive oriented".

Observers have noted that the Indonesian rice farmer is one of the most skilled in Asia /8, p. 2/ and many now have considerable experience in the use of fertilizer and pesticides. But these farmers have stubbornly refused to "modernize" unless the relative price of fertilizer to rice was favorable. This sensible attitude has even been formalized into the "Rumus Tani", or farmer's formula, which says that a kg of urea should cost no more, to the farmer, than a kg. of milled rice can be sold for, at the farmgate, to make the extra cost and effort of fertilizer use worthwhile. 3/

3/This was probably a pretty good guideline until the high-yielding seeds emerged and significantly lowered the cost curve. In 1969, Mears and Afiff /13/ calculated incremental benefit/cost ratios of approximately 1.5-2.0 when the Rumus Tani was met for high-yielding seeds. Preliminary results from the BIMAS (cont. on p. 11).

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The new program has thus introduced considerable flexibility into the intensification package. The implementation stresses getting seeds, fertilizer, and pesticides to the farm level at favorable prices, providing subsidized credit through the village banking credit unit of BRI, (Bank Rakjat Indonesia, the "People's Bank"), sending mobile teams of extension and program experts to explain the use of inputs and how the program functions, and then guaranteeing the farmer a profitable floor price for his padi. The individual farmer is then free to decide whether he will participate in the program, and to what extent, up to 100% of the recommended program.

One major aspect of the implementation has been to trust the private market, at least partially, to distribute fertilizer. This is in striking contrast to previous years when the state-owned P.N. Pertani was the sole distributor of fertilizer. Due to a number of institutional and management problems, P.N. Pertani often acted as a stock maximizer rather than a sales maximizer. Now P.N. Pertani has been joined by PUSRI 4/ and Pertamina as major distributors, as well as by a handful of smaller companies. All firms are charged to sell urea and T.S.P. at the village level at no more than 26.6 Rp/kg. Beyond this injunction (enforcement of which falls largely in P.N. Pertani's hands), the firms are free to compete. The price of 26.6 Rp/kg contains a subsidy of perhaps 7-8 Rp/kg which is covered from the Development Budget.

The implementation of an effective floor price is the other major innovation in the program. Although attempts were made in the wet season harvest in 1969 to support padi prices at a profitable level, the effort was generally unsuccessful as is shown in Table 3:

(cont.)
evaluation study show much higher ratios to farmers using the new seeds. So even a Rumus Tani ratio of 0.8 would still be extremely profitable on the average for adopters of PB-5 (i.e. IR-5).

4/PUSRI operates its own urea production plant in Palembang.

Table 3: Average Prices for Padi in Rural Markets, April-July (Wet Season Harvest), 1969 and 1970, in Rp/kg.

		West Java	Central Java	East Java	South Sulawesi
Bulu No.1	1969	15.82	14.19	11.81	12.92 1/
	1970	22.12	19.24	16.69	18.58 1/
	% Change	39.8%	35.6%	41.3%	43.8%
Bulu No.2	1969	14.50	13.30	10.80	13.37 2/
	1970	20.56	17.87	15.42	16.00 2/
	% Change	41.8%	34.3%	42.8%	19.7%
Tjere No.1	1969	13.65	12.77	11.16	11.00 3/
	1970	19.42	17.28	15.94	13.50 3/
	% Change	42.2%	35.3%	42.8%	22.7%
Tjere No.2	1969	12.11	11.50	10.22	10.83 1/
	1970	17.95	16.10	14.86	NA
	% Change	48.2%	40.0%	45.4%	NA

SOURCE: IPEDA Reports (Central Bureau of Statistics)

1/May-July only 2/July only 3/June only 4/June-July only

Rural prices in 1969 for average quality Tjere padi (Bulu variety sells at above average prices) were uniformly below the prices thought necessary to make widespread fertilizer use profitable. The policy outlined by Mears and Afiff / 13 / in August, 1969 was designed to raise these prices to the farmer (and still maintain retail price stability).

The operational agency responsible for supporting the floor price is BULOG, the Food Logistic Board. It's charge is to buy as much milled rice at the rice mill as is necessary to keep the price from falling below 36 Rp/kg. BULOG offers a small incentive for better quality rice (lower percentage brokens) but makes no varietal differentiation (which is more important in Indonesia, where taste rather than quality per se is still the major factor determining price). There are no seasonal or spatial dimensions to the floor price policy.

BULOG also has contracts whereby it purchases stalk padi or gabah (rough rice), but the minimum size of contracts has been five tons, which discourages most farmers from selling directly to BULOG. One of the major unresolved factual questions in Indonesian rice marketing is whether the farmer actually received 13.20 Rp./kg for his padi even if the mill receives 36 Rp/kg for its milled rice, and the minimum urban retail price is 42-43 Rp/kg. The bulk of the evidence suggests that he does, but this evidence remains unsubstantial.

By most standards of comparison, implementation of the floor price in 1970 was successful, with padi prices considerably higher than in 1969 (see Table 3, above), as BULOG bought almost 500,000 tons of milled rice. In 1969 only about 200,000 tons were purchased. The 1970 Dry Season crop was exceptionally good, spurred by heavy rainfall and, presumably, by the availability of inputs and flexibility in the intensification program. And only in 1970 did Indonesian rice production finally make up all the ground it has lost in the mid-1960's. An optimistic trend line drawn through production in 1955 and 1960 is not reached again until the 11.6 million ton production in 1970. The prospects for a 1971 crop of about 12.5 million tons now look good. This would be one million tons more than the 1955-60 trend.

Consumption

Rice policy in Indonesia has traditionally been consumer oriented, with adequate supplies at low prices (below world market levels) the major concern of the government. Keeping rice prices low helped keep Indonesia's labor intensive export products competitive in world markets even with inefficient production and marketing techniques, and also minimized the potential for urban unrest.

Official policy of the present government has attempted to redress this one-sided policy by implementing the profitable floor price to farmers discussed above, but it has not discarded its concern for consumers' interests. Indeed, rice price stability is still the basic ingredient in the development effort, and this stability is primarily a matter of holding a ceiling price for rice. The farmer is protected by a government offer to buy all rice offered at 36 Rp/kg at the rice mill and the consumer is protected by government sales of rice to hold an urban ceiling level of 50 Rp/kg for medium quality rice.

The spread between these two prices was consciously designed from the limited information available to provide at least minimum incentives to the private rice trade to accumulate and carry stocks from harvest to *patjeklik* (the preharvest period). [13] Private costs of carrying stocks have been estimated at between 3.5%-6.5% *per month*, with interest charges making up 57%-77% of this total [11, p.23]. Even at the minimum rate of 3.5% per month the private trade needs a price rise of 21% just to carry stocks for six months. Since a price of 36 Rp/kg at the mill translates to about 42 Rp/kg in the urban markets (although this spread seems to vary seasonally and shows some evidence of declining), the total seasonal variation permitted is only about 19%. A trader who buys in May at the floor price must sell by November at the ceiling price to earn any return at all. And indeed, in 1969, the private trade in West Java did seem to exhaust their stocks, at least for the Djakarta market, by October or November, even though they bought the rice very cheaply before a successful floor price policy was implemented.

Still, the picture is not as bleak as it seems. At least on Java, rice is harvested all year long, with the big peak in April-June and a smaller (dry season) peak in September-October. So the private trade buys and sells rice continuously. In addition, the price spread between the floor and ceiling price is larger than it appears. BULOG makes no varietal distinction in purchasing at the floor price, and only guarantees that an "average" variety and quality rice will be available for 50 Rp/kg at *Patjeklik*. The private trade can buy BGS Krawang variety close to the floor price, for instance, but sell it in Djakarta at *patjeklik* for 3-5 Rp/kg more than the ceiling price. The "indicator price" is BGA Krawang, which is a

notch below

BGS at patjeklik. Whatever the trading techniques and margins, the private trade seems to be carrying a larger proportion of the marketed surplus. In 1970 they supplied the Djakarta market beyond December and into mid-February, 1971, before BULOG was called upon to defend the ceiling price.

BULOG implements the ceiling price policy in two separate fashions; one direct and one indirect. The direct tool is through urban market injections whenever the retail price of the indicator variety exceeds (or threatens to exceed) 50 Rp/kg. Then, working through large rice wholesalers or sometimes selling directly to the small retailers in the markets, BULOG moves rice into the markets at a price of 47 Rp/kg. The 3 Rp/kg margin provides adequate room to keep the final retail price at 50 Rp/kg. There is no regional variation in the ceiling price at the moment.

With taste conscious consumers such as exist in Indonesia, the rice chosen as the indicator variety, and its substitutability with the injected variety are very important. It has happened in a number of markets that BULOG has attempted to control the price of the local variety rice by injecting U.S. or Japanese imported rice, to little effect /see 22/. In Palembang, for example, the local variety which had been used as the indicator variety rose in price to 60 Rp/kg although U.S. medium grain rice (of better "quality") was amply available in the market for 49 Rp/kg. Concern for these sorts of details, of course, came only after the general stabilization effort had been successful, but they are crucial for a final evaluation of the successes and failures of the program.

The second tool BULOG uses in the stabilization effort is direct rice distributions, as payment in kind, to the military, civil servants and employees of national companies (PN's and PNP's). This policy grew out of the inflation of the 1950's when the only way to protect government workers' wages was to pay a substantial part of them in kind. These physical distributions still total about 1,000,000 tons per year, and in terms of quantities, are three to four times larger than market injections. There is some desire to reduce these distributions over time in favor of cash payments, in the interests of increased allocative efficiency (and lowering BULOG's deficit -- partly caused by losses in this aarea). But stabilization will have to be a permanent feature of the economy before much progress is made here, and the private trade will have to be developed in many regions to handle the extra volume.

In the past there has been some conflict between the two demands on BULOG stocks. Since the physical distribution scheme was well established before the ceiling price policy, regional BULOG officials (in the DOLOGs, or Deport Logistics) were often reluctant to sell stocks to the markets if they were uncertain of having adequate supplies to cover their distribution needs. Resolving this conflict has called for two different approaches. The first has been a process of educating the DOLOG officials about the new government policy. The second has been to get stock levels high enough that most of the conflict disappeared. During 1970 very substantial progress was made on both fronts.

As was noted earlier, BULOG was basically unsuccessful in supporting farm prices in 1969, and purchased only 200,000 tons of milled rice instead of the 500-600,000 tons thought necessary to keep prices up. In the face of a poor dry season crop late in 1969, BULOG's total stocks were inadequate to defend the price stabilization policy from the top. By the end of September, 1969, total BULOG stocks were only 207,000 tons, about two months of normal distribution requirements, but not nearly sufficient to support extensive market operation. October injections were 14,000 tons, December 15,000 tons -- less than half and possibly only a quarter of what was needed to hold a 50 Rp/kg price ceiling throughout Indonesia.

This experience reinforced the need to build up a substantial buffer stock from which supplies could be drawn in the short run while imports were being arranged. The desirability of such a buffer stock was discussed as early as 1967 /10/, but the holding of a substantial buffer stock as part of the price stabilization program was not really implemented until 1970. Stocks at the end of the year exceeded 500,000 tons.

The sources of rice for the buffer stock (and thus for distribution and market operations) are both domestic and foreign. The domestic rice accrues from the floor price policy. The amount forthcoming is difficult to predict until after the harvest comes in (and sometimes well after that!), and since BULOG pursues a price rather than a quantity target, planning must be very flexible. These planning requirements are becoming even more exacting as the proportion of domestic rice in the BULOG supply rises as the intensification program succeeds. And the intention, of course, is that BULOG will meet all of its requirements from domestic rice by the end of the Five-Year Plan.

In the meantime, and historically, imports have been used to fill the gap between available domestic supplies and the quantity required to meet distribution requirements and market operations to hold the ceiling price. Although commercial purchases composed the bulk of the imports in the early 1960's, a critical balance of payments deficit and the need to generate rupiah proceeds to finance the government's development effort led to large PL 480 and Japanese food aid rice imports in the past several years. This aid-financed rice, and the wheat flour that accompanied it, have had a major impact on Indonesia's

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economy. Most of the first year's Development Budget was financed from the rupiahs generated by the sale of these commodities, and the foreign exchange saved was used to import capital development goods. So the dual nature of the price stabilization policy is revealed once again.

Large quantities of aid-financed wheat flour were programmed in 1968, in addition to rice, as part of the stabilization effort. Although the quantities originally envisioned (up to a million tons per year) never materialized, substantial volumes were imported, with short and long run effects. Table 4 shows some of the more recent statistics for wheat flour.

Table 4: Wheat Flour Statistics

Year	Imports (000 tons)	Per Capita Consumption (kg)	Wheat Flour Price Relative to Cheap Quality Rice
1965	32.4	0.309	2.289
1966	44.9	0.420	3.023
1967	146.7	1.346	1.482
1968	366.8	2.476	0.923
1969	347.1	3.529	1.072
1970	504.1	4.354	1.119

SOURCE: PL 480 Team and BAPPENAS

Aid financed flour was 12.5% of the imported amount in 1968, 75.2% in 1969, and 100% of the 1970 supplies.

Analysis of statistics reaching back to 1950 reveal that wheat flour has long been imported into Indonesia in modest quantities, and the per capita consumption in 1956 was not exceeded until 1968. The factors determining the level of wheat flour consumption are complex, as there are four other major carbohydrates also consumed in Indonesia. But because wheat flour played a major role in the price stabilization effort, research was conducted to unravel some of these factors [26].

The results, briefly, indicate that wheat flour consumption in Indonesia is very sensitive to changes in prices. Holding other factors constant, a 10% *decrease* in the price of wheat flour leads to a 14% *increase* in the per capita amount consumed. Thus the own price elasticity is -1.4.

Rice prices also affect wheat flour consumption, with a 10% *increase* in rice prices leading to a 12% *increase* in wheat flour consumption, holding wheat flour prices constant. The cross-price elasticity is 1.2.[5/] These elasticities are very high and are probably caused by two things: 1) wheat flour is still consumed in very small quantities mostly by higher income groups (the cross section expenditure elasticity in Djakarta is 1.8), and 2) the wide range of carbohydrates available makes cross substitution very easy. The expenditure elasticity and own-price elasticity will probably decline as wheat flour consumption increases.

Since no significant production of wheat grain is ever likely in Indonesia, all demand for wheat flour and wheat products will be met from imports. In the current precarious financial and balance of payments situation this hopefully means aid-financed wheat and wheat flour. But the government has at least implicitly committed itself to the long-run consumption of wheat flour in Indonesia by licensing three wheat flour mills. By the end of 1972 they will be able to supply all of Indonesia's wheat flour requirements.

Prices

The ultimate test of a price stabilization policy is prices. We measure consumer welfare not by how much rice (or cassava, or peanuts) is eaten, but by whether the population can buy as much as it wants at a fair price. For several excellent reasons including the income and employment effects for farmers, it is desirable to produce enough rice domestically to guarantee this fair price. But in the end it is price behavior that determines how successful rice policy has been. The role that rice policy might be expected to play in the equity issues of regional and personal income distribution will be discussed in the third section.

What is the score? Clearly, 1969 might be written off as a year of trial and error and learning for all concerned. But even by 1968 substantial progress was being made on the broad scope of integration of the rice market and dampening seasonal price movements. Table A-4 shows that the decline from 1962 to 1966 in the average deviation of low and high prices from average prices (from 148.3% to 112.1%) continued in 1968. In February the total deviation still exceeded 100%, with the retail price in Palembang almost three times the level in Makassar. As in the earlier years, these were not just isolated extremes -- Djakarta's price was two and a half times as high as the price on Bali. By May and October however, the high prices were only a little more than double the low prices and

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[5/] These elasticities were calculated from time series data using a logarithmic demand function and are significant at a 95% confidence level.

there was considerably more clustering about the average. Seasonal variations were also dampened, with no region's high price varying from its low by more than 50%. In 1962 Bali's high price was 260% above its low.

Some further progress was made in 1969, but the dramatic gains were achieved in 1970 and in the current year. The years of learning and experimentation are paying off. From an average sum of deviations in 1968 of 83.6% the 1970 average fell to 50.1%, probably the lowest in modern Indonesian history. The stability in some places was especially striking: in Ambon the average price of (imported) rice never varied from 50 Rp/kg. In Medan and Bandjarmasin the floor price was broken at one season and the ceiling price at another. Both aspects have now been successfully tackled in Medan (the February, 1971, price was above the floor, in contrast to February, 1970). Several cities in Kalimantan continue be problems as the transportation system is still inadequate (the same is true of the Pakanbaru area of Sumatra), but substantial efforts are being made to bring these areas into the national market as well.

The results, then, have been markedly increased production and consumption of rice at stable prices. Production increased from 9.05 million tons in 1967 to 11.6 million tons in 1970. Consumption has risen from 79.5 kg per capita to 93.9 kg in the same period. Deflated rice prices are slightly lower now than in 1967, and actual prices are lower than in 1968 (when rice prices were unusually high on Java). In terms of the specific goals given it, the rice policy has been a success up to now.

The price policy that has been part cause and part effect of this effort has emphasized stabilization around an equilibrium price level, not support above it or control below it. But the extremely wide spatial and temporal price variations that prevailed in Indonesia prior to the present policy gave scope for both price support and price control. The government, by breaking down barriers to trade, building infrastructure and utilizing a government agency to enforce reasonable price limits, was able to provide improved price incentives to farmers and better price protection to consumers. Farmers responded by using more inputs and producing (and consuming) more rice. Consumers reacted, through higher incomes and better relative prices, by consuming more rice. The stabilization policy has apparently had real welfare significance for a large proportion of the population.

III. Repelita and Beyond: 1972 - ?

Repelita I : Consistency and Outlook

The rice production target in Repelita is 15.42 million tons, an increase of 51.6% from the 1968 base of 1) 10.17 million tons. With a knowledge of the production programs, consumption trends and price policy, it is now time to ask three basic questions :

1) Can Indonesia produce 15.42 million tons of rice in 1973/74?

2) If it is produced, can Indonesia consume 15.42 million tons of rice in 1973/74?

3) If it is produced and consumed, what will happen to rice prices, both absolutely and relative to other food prices?

Can it be produced? -- Table A-6 shows the Repelita production targets and the necessary inputs to achieve them, on an annual basis. The plan called for substantial expansion in both area harvested and in yields per hectare. Only 400,000 hectares of the total 1,700,000 hectare increase was to be in new technically irrigated acreage. The rest was expected to come from rehabilitation of presently irrigated land and expansion of rainfed padi.

The yield increases were programmed in accordance with the potential of the high-yielding seed varieties on 4,000,000 hectares and total fertilizer application that would more than double base year rates. The resulting yield and area figures are technically consistent with the production target of 15.42 million tons. The real question is whether these figures can be achieved.

The evidence to date suggests that while the irrigation work is going more slowly than anticipated, differential yields on the intensification areas are higher than planned, and the production program stayed on or above target for the first two years of the Plan. Current prospects for the wet season harvest in progress now make the target level of 12.5 million tons in 1971 at least possible, and perhaps even probable. With the advent of new seeds better adapted to Indonesian conditions,[6] the odds/producing 15.42 million tons of rice in 1973 remain at least even provided the government remains committed to the target.

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[6] Two locally bred varieties with field trial yields exceeding PB-5 were released for multiplication in March

Can it be consumed? -- Projecting self-sufficiency requirements is a complicated exercise, and a realistic effort must take account of the change in population, the extent and composition of the change in incomes, the likely course of prices of competing foodstuffs and the potential for substitution, and any changes in tastes. Two papers have recently examined these factors in some detail /_9,27_/. No specific projections emerged from either paper because the ultimate outcome depends strongly on government policy. But the factors leading to various consumption levels in 1973 are interesting indeed.

Expenditure elasticities for rice seem to be quite high for a basic foodstuff. Table 5 shows expenditure elasticities for quantity of rice consumed, by expenditure class, for urban and rural households on Java.

Table 5: Expenditure Elasticities for Rice on Java

Monthly Expenditure Class	Urban	Rural
Less than Rp. 300	0.75	0.92
	(.1371)	(.4238)
Rp. 301 to 1000	0.44	0.63
	(.7217)	(.5434)
More than Rp. 1000	0.13	0.34
	(.1412)	(.0328)
Weighted Average	0.44	0.74
	(1.000)	(1.000)

SOURCE: Sept. - Oct. 1967 Household Consumption Survey

The weighted average elasticity for urban and rural Java combined is 0.69, based on relative population weights of 0.1635 (urban) and 0.8365 (rural). Evidence from this survey and a later one in Djakarta in early 1969 show that the expenditure elasticity declines smoothly with higher expenditure levels (the "elasticity of the elasticity decline" is -0.5). When adjustment for rising per capita incomes from 1967 to the present is carried out, an expenditure elasticity of 0.65 as a best estimate for Java results. At present income and savings levels, no distinction is made between expenditure and income elasticities.

No successful empirical research on the own and cross price elasticities for rice has yet been reported. The magnitude of the income elasticity would suggest a price elasticity of at least -0.5 if no cross price elasticties are considered, but the easy extent of cross substitution with other carbohydrates has already been noted, and suppressing this would probably conceal significant sources of change. Accordingly, in the demand calculation below, a cross-price elasticity (with a composite of competing carbohydrates) of 0.3 or 0.5 is used, with an own price elasticity (relative to the general commodity bundle excluding carbohydrates) of -0.1 or -0.3. The "total" price elasticity then can range from 0.4 to 0.8 if money rice prices remain stable and all other prices change.

Table 6 shows the consumption consequences of holding the price of rice at present levels through the stabilization policy while other prices in the economy rise. The results are generated from a consumption function of the form

$$C = AP_r^{a'} P_o^{b} I^{c} N^{d}, \text{ where}$$

C = total rice consumption in million of tons
a'= own price elasticity of rice (-0.1 or -0.3)
b = cross price elasticity of rice with competing carbohydrates (0.3 or 0.5)
c = income elasticity (0.65)
d = population elasticity (1.00) (Population growth rate of 2.0% per year assumed, which is probably too low).

The results are rather striking in their wide range and, if nothing else, provide some rationale for explaining the large increases in per capita rice consumption in 1969 and 1970 at "stable" prices. First, of course, because of the very high rural income elasticities at low income levels, a large chunk of any increased production is eaten on the farm (average farm size on Java is well below 0.5 hectare, so the average farmer is in the low income class). But secondly, the general price level moved up about 10% each year and some of the other basic carbohydrates became more expensive relative to rice. The nation seems to eat all the rice that it can grow.

What happens to price? -- In order to produce 15.42 million tons of rice in 1973/74 much of the government's energies devoted to agriculture will go to rice. Repelita calls for substantial increases in all the foodcrops, but these are simply not being realized. The suspicion is that this is not only because of government inattention, but that favorable rice prices and credit availability under the BIMAS program have shifted farmers on marginal fields out of cassava and maize and into rice.

Unless this unbalance is corrected (and there seems no good reason why it should be except that maize is a good export crop -- rice is considered a superior foodstuff by maize and cassava eaters), it appears likely that production of these alternate carbohydrates will continue to stagnate or decline. If rice prices are held at present levels, prices of maize, cassava and sweet potatoes will likely increase, if for no other reason than a lack of a cost reducing technology (maize may be an exception). The possibility of removing all inflation from the Indonesian

Table 6

Gross Consumption of Rice in 1973, in million tons [1]

Value of a'		-0.1				-0.3			
Value of b		+0.3		+0.5		+0.3		+0.5	
% Increase in cost of living index ex rice per year		5%	10%	5%	10%	5%	10%	5%	10%
% Increase in price of rice substitutes per year	% increase in per capita incomes per year								
0%	2%	13,59	13,79	13,59	13,79	13,98	14,59	13,98	14,59
	3%	13,85	14,04	13,85	14,04	14,25	14,86	14,25	14,86
	4%	14,11	14,31	14,11	14,31	14,51	15,14	14,51	15,14
	5%	14,37	14,57	14,37	14,57	14,78	15,41	14,78	15,41
5%	2%	14,19	14,39	14,59	14,80	14,59	15,22	15,01	15,65
	3%	14,45	14,66	14,86	15,07	14,86	15,50	15,28	15,93
	4%	14,72	15,16	15,14	15,35	15,14	15,78	15,56	16,22
	5%	14,99	15,20	15,41	15,63	15,41	16,06	15,84	16,50
10%	2%	14,80	15,01	15,65	15,86	15,22	15,86	16,08	16,75
	3%	15,07	15,28	15,93	16,15	15,50	16,15	16,37	17,05
	4%	15,35	15,56	16,22	16,44	15,78	16,44	16,66	17,35
	5%	15,63	15,84	16,50	16,73	16,06	16,73	16,96	17,65
15%	2%	15,43	15,65	16,75	16,98	15,86	16,53	17,21	17,91
	3%	15,71	15,93	17,05	17,28	16,15	16,82	17,51	18,21
	4%	16,00	16,22	17,35	17,58	16,44	17,12	17,81	18,53
	5%	16,28	16,50	17,65	17,88	16,73	17,42	18,12	18,84

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[1] The assumptions other than the ones shown in the table, are a 2,0% per year population growth, an income elasticity of 0.65 for all years, and 1970 base year consumption of 12,15 million tons.

economy seems slim -- a rate of 5% a year would probably be happily accepted by most officials over the next five years.

What this all means for rice consumption is that 15.42 million tons can be consumed if relative rice price fall. The fall need not be much, nor out of line with experience in the past few years. For instance, if own price elasticity is -0.3 and cross price elasticity is 0.3, 15.42 million tons of rice can be consumed if the general price index and the prices of competing carbohydrates both increase 5% per year, and per capita incomes increase at 5% per year (the level of the past year, and certainly a possibility over the next 3-5 years if the planned rice production targets are realized). A number of other combinations, all of them within reason, will generate the same consumption. But all involve some fall in the real price of rice.

The Role of Rice in Indonesian Development

What then is the role of rice in Indonesian development? Can the government pursue a policy of stable money prices but declining real prices for rice and still reach its self-sufficiency goal? The answer depends on whether the input subsidy program is continued and how widely the new cost reducing technology can be adopted. If inputs continue to cost the same and output continues to sell for the same, then the benefit/cost ratios are the same. If a high benefit/cost ratio motivates the farmer to modernize and increase output, then he will continue his efforts.

But it is total real income that the farmer is ultimately after, not a benefit/cost ratio, and here the cost reducing technology is crucial. Even lower prices can lead to higher profits if the average costs of production fall fast enough. And this is the ultimate promise of the miracle seeds. If this strategy could be successfully implemented it would provide progressively cheaper rice as agriculture's contribution to development. Achieving this agriculture-to-other-sectors transfer seems to be a critical factor in achieving self-sustaining economic progress. Whether it is too soon for Indonesia's rice sector to play this role is not yet known, but the answer is likely to emerge before the end of Repelita I.

Some Unanswered Questions

It is probably fair to say that there is not a single aspect of the Indonesian rice economy that does not need substantial research. Placing priorities is difficult. But ......

1. The rice intensification program, and the resulting increases in production, have meant substantial increases in income for farmers. It is very likely however, that these increas-

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es have not been uniformly distributed among farmers and probably those most in need of income gain have been benefited least. How can a rice intensification program reach the very small landowner (0.1-0.3 Ha) and landless laborers? Will the cost of such an effort chew up the gains from the larger farms, leaving total income unchanged but redistributed? Can the country afford such an effort? Can it afford not to?

2. What is the employment potential of the rice program? Javanese rice culture especially is exceedingly labor intensive. Does raising yields provide more work for more workers, or does it "merely" increase the productivity of the present work force? What policies can further the laborization of rice farming and prevent its capitalization? Does this involve a trade-off with rising output?

3. Not all regions in Indonesia have equal potential to participate in the rice intensification program. Are the effort and resources going into this program causing regional frictions? What alternative development potentials do the non-rice growing regions have that could be fostered to promote equitable growth? Are the human and financial resources available to promote them? What will regional equity in growth cost in terms of total output foregone? How has the price stabilization policy per se benefited (or cost) each region?

4. There are a number of other important questions about the price stabilization program. What are the actual size of the marketing margins at each stage from the farmer to the consumer? How can they be narrowed? What is the proper size of BULOG's buffer stock? Should regional price differentials be introduced into the ceiling price? The floor price? Should greater differentials be paid for better quality? For different varieties? The USAID sponsored Rice Marketing Teams now in country should provide some guidance on these questions.

5. Indonesia has embarked on a rice self-sufficiency program without knowing exactly what the economic costs (or benefits) are. Because of the present availability and low price of rice in world markets, some fears have been expressed that Indonesia's rice intensification program produces rice at greater cost than imports. The cost involved is not just monetary, but in terms of the time and attention top level policy makers put into the rice program. Perhaps these resources could be used to better advantage in other crops or in other sectors. So it is important to know just what the marginal cost of rice is. What are the benefits and costs of the BIMAS program. If it would be cheaper to import [redacted], how much is Indonesia giving up economically to reach a non-economic goal? The BIMAS Evaluation Study will be casting light on these issues, although only the government can answer them in the end.

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6. Our knowledge of the Indonesian farmer is pathetically sparse. What motivates him? Which factors that he uses causes increased output and which follow along? Do the very small size holdings cost anything in economic efficiency? Are there social benefits?

7. The consumption function has received more attention than any of the above topics, but there are still some big holes. What is the price elasticity of demand for rice? What are the cross elasticities? What is the nature and extent of cross substitution with other carbohydrates? How are tastes changing?

There are a lot of questions and few answers. Implementation of the next Five-Year Plan is less than three years away; its drafting only two years. There is time to organize and conduct the research that will answer most of these questions, but a start must be made now.

Table A-1 : Comparative Per Capita Production of Carbohydrates (kg.)

	Milled Rice	Maize[1]	Cassava[1]	Sweet Potatoes[1]	Total Carbohydrate Production[1]	Rice as % of Total
1960	89.2	25.0	39.3	8.4	161.9	55.1
1961	84.9	23.4	39.0	7.8	155.1	54.7
1962	89.3	32.5	38.8	11.4	172.0	51.9
1963	77.8	23.1	38.9	9.3	149.1	52.2
1964	80.6	36.0	39.9	11.7	168.2	47.9
1965	82.9	22.1	40.2	7.7	152.9	54.2
1966	84.9	33.9	34.8	7.0	160.6	52.9
1967	80.5	21.0	32.5	5.9	139.9	57.5
1968	88.3	27.5	33.5	4.7	154.0	57.3
1969	91.5	19.2	31.2	5.0	146.9	62.3
1970	95.8	20.1	29.2	4.9	150.0	63.9

[1] In terms of milled rice equivalent.

Source: Central Bureau of Statistics.

Table A-2

Area Harvested and Milled Rice Production in Indonesia, 1953/1969

Year	Area Harvested in Millions of Hectares			Production in Millions of Metric Tons			Yield in Tons of Milled Rice per Hectare		
	Java	Outside Java	Indonesia	Java	Outside Java	Indonesia	Java	Outside Java	Indonesia
1953	4.02	2.45	6.47	4.43	2.88	7.31	1.10	1.18	1.13
1954	4.16	2.46	6.61	4.82	3.02	7.84	1.16	1.23	1.18
1955	4.19	2.38	6.57	4.59	2.92	7.51	1.09	1.23	1.14
1956	4.30	2.40	6.70	4.76	2.84	7.60	1.10	1.18	1.13
1957	4.31	2.49	6.80	4.74	2.89	7.63	1.10	1.16	1.12
1958	4.39	2.60	6.99	4.95	3.03	7.98	1.13	1.16	1.14
1959	4.33	2.82	7.15	5.05	3.24	8.29	1.17	1.15	1.16
1960	4.32	2.96	7.28	5.06	3.70	8.76	1.17	1.25	1.20
1961	3.99	2.87	6.86	4.80	3.47	8.27	1.20	1.21	1.21
1962	4.09	3.19	7.28	5.14	3.75	8.89	1.26	1.17	1.22
1963	3.65	3.08	6.73	4.44	3.49	7.93	1.22	1.13	1.18
1964	3.66	3.32	6.98	4.37	4.05	8.42	1.19	1.22	1.21
1965	4.19	3.42	7.61	4.87	3.97	8.84	1.16	1.16	1.16
1966	4.11	3.67	7.78	4.66	4.48	9.14	1.13	1.22	1.17
1967	4.02	3.50	7.52	4.98	4.07	9.05	1.24	1.17	1.20
1968	4.26	3.75	8.01	5.54	4.62	10.17	1.30	1.23	1.27
1969	4.33	3.88	8.21	5.84	4.96	10.80	1.35	1.28	1.32
1970 prel.	N.A.	N.A.	N.A.	6.44	5.15	11.59	N.A.	N.A.	N.A.

Table A-3 : Rice Consumption in Indonesia (millions of tons)

Calendar Year	Gross Production	Net Production[1]	Imports	Total Available for Consumption	Population (millions)	Per Capita Consumption[2] (kg)
1958	7.98	7.50	0.71	8.21	91.1	90.1
1959	8.29	7.79	0.61	8.40	93.2	90.1
1960	8.76	8.23	0.89	9.12	95.3	95.7
1961	8.27	7.77	1.01	8.78	97.4	90.1
1962	8.89	8.36	1.01	9.37	99.5	94.2
1963	7.93	7.45	1.07	8.52	101.7	83.8
1964	8.42	7.91	1.02	8.93	104.0	85.9
1965	8.84	8.31	0.14	8.45	106.7	79.2
1966	9.14	8.59	0.24	8.83	109.4	80.7
1967	9.05	8.51	0.35	8.86	112.2	79.5
1968	10.17	9.56	0.63	10.19	115.1	83.8
1969	10.80	10.15	0.60	10.65	118.1	93.1
1970	11.59	10.89	0.95	11.84	121.1	93.9[3]

1/ Estimated at 94% of gross production, with 6% for seed and losses.

2/ After allowance for change in government stocks and estimated changes in private stocks, as follows: 1967: -.06, 1968: +.55, 1969: -.34, 1970: +.47

3/ The per capita consumption would be 98.7 if the 1970 Headcount (for the General Election) of 115.2 million is an accurate population figure. A full Census will be conducted in 1971.

Table A-4

Average Price of Medium Quality Rice, Rp./Kg

	1962[1/]			1966			1968			1970			Feb. 1971
	Feb.	May	Oct.	Feb.	May	Oct.	Feb.	May	Oct.	Feb.	May	Oct.	Average
Java													
Djakarta	56.25	30.79	38.69	4.18	6.12	8.40	73.95	50.90	43.89	57.25	44.61	46.48	50.30
Bandung	52.13	34.31	38.52	3.67	4.91	8.30	72.95	48.41	44.24	53.34	42.70	44.00	48.25
Semarang	38.25	28.73	34.25	2.90	4.75	9.40	50.99	40.60	33.74	49.17	40.98	44.13	47.19
Jogjakarta	-	-	-	2.35	4.10	7.50	49.10	36.29	37.55	46.73	37.17	39.26	44.88
Surabaja	25.39	22.16	30.00	2.80	2.90	9.00	51.38	34.58	38.00	47.50	35.35	39.63	41.50
Sumatra													
Medan	31.33	52.58	120.53	1.54	3.30	12.50	36.39	56.30	64.00	34.75	41.68	53.13	43.75
Padang	51.50	66.94	69.68	2.67	3.44	10.00	39.87	53.01	52.41	42.39	43.75	43.75	47.00
Pakanbaru	31.21	66.06	90.19	2.50	3.80	12.00	46.64	58.00	60.10	50.13	49.75	50.00	58.75
Palembang	80.00	65.00	60.31	2.90	4.60	7.50	75.95	38.47	49.95	46.67	60.00	47.00	49.88
Kalimantan													
Pontianak	-	-	-	-	7.00	-	45.00	51.60	-	52.00	52.00	54.50	51.00
Bandjarmasin	24.96	60.10	32.24	3.65	5.30	4.30	34.23	42.49	27.23	53.80	50.25	31.25	43.06
Balikpapan	-	-	47.50	-	-	-	36.70	27.00	62.00	52.50	47.50	48.75	48.00
Sulawesi													
Makassar	23.93	25.11	30.24	3.44	3.44	4.65	26.35	40.27	27.60	43.75	39.13	39.50	42.63
Palu	-	-	-	-	-	-	-	44.74	34.37	53.75	47.00	52.25	49.25
Menado	-	-	-	3.80	3.50	16.00	47.60	57.13	61.75	46.63	48.25	49.50	49.00
Other Islands													
Denpasar (Bali)	13.25	22.33	48.00	1.50	2.75	6.00	31.88	39.38	41.25	43.66	44.50	43.25	47.63
Ambon	-	-	-	3.75	8.00	10.00	46.67	56.00	60.00	50.00	50.00	50.00	48.50
Simple Average	38.97	43.11	53.36	2.98	4.53	8.97	48.23	45.93	46.13	48.60	45.56	45.67	47.68
% Deviation from Average													
High	105.3%	55.3%	125.9%	40.3%	76.6%	78.4%	57.5%	26.9%	38.7%	17.8%	31.7%	19.3%	23.2%
Low	-66.0%	-48.6%	-43.8%	-49.7%	-39.3%	-52.1%	-45.4%	-41.2%	-41.0%	-28.5%	-22.3%	-31.6%	-13.0%
Sum of Absolute %	171.3	103.9	169.7	90.0	115.9	130.5	102.9	68.1	79.7	45.3	54.0	50.9	36.2%
Average of Sum		148.3%			112.1%			83.6%			50.1%		

1/ In old rupiahs, equal to 1/1000 of new rupiah.

Source : BULOG

Table A-5 : Land Area, Use and Population Pressure
(in sq. Km.)

	Java and Madura	Suma-tra	Kali-mantan	Sula-wesi	Bali and Nusa Tenggara	Moluccas and W. Irian	Total Indonesia
Total Land Area	132,174	473,606	539,460	189,035	73,614	496,456	1,904,345
1971 Population (millions)	80.19	20.38	5.31	9.17	7.19	2.00	124.24
Population per km.^{2}	607	43	10	49	98	4	65
Wooded Area	31,572	284,200	414,600	99,100	12,200	375,000	1,216,772
Agricultural Area	97,423	25,855	8,177	12,488	10,964	1,085	155,992
Agricultural Area Per Capita, Ha	0.12	0.13	0.15	0.14	0.15	0.05	0.126
Farm Food Crop Area	82,820	15,170	6,930	8,390	9,710	180	123,200
Wet Paddy Land	25,280	7,780	2,790	2,470	2,430	N.A.	40,750
Wet Paddy Land Area Harvested	30,220	7,160	2,260	2,450	2,690	N.A.	45,220
Area Harvested as % of Total[1]	120%	92%	81%	99%	111%	-	111%

[1] This is a measure of the extent of double cropping of rice.

Source: Central Bureau of Statistics, Statistical Pocket Book of Indonesia, 1960 except for Area of Wet Paddy Land and Wet Paddy Land Harvested, which are from the 1963 Agricultural Census and reported in the Statistical Pocketbook of Indonesia, 1967. The 1971 population figures are from a press release of the Central Bureau of Statistics.

Table A-6: Sources of Increases to Produce 15.42 million tons of Rice in 1973/74

	1969/70	1970/71	1971/72	1972/73	1973/74
Production Target (million ton)	10.52	11.43	12.52	13.81	15.42
Harvested Area (million Ha)	7.60	7.96	8.32	8.76	9.30
Average Yields (tons/Ha)	1.38	1.43	1.51	1.58	1.66
Area Under Intensification (million Ha)	2.59	2.90	3.15	3.48	4.00
of which in HYV	0.79	1.40	2.15	3.08	4.00
Fertilizer Application [1] (000 tons)					
Urea	338	430	530	676	800
T.S.P.	169	215	265	328	400
Insecticide Applications [1] ($ millions)	15.70	16.60	17.50	18.50	20.10
Technically Irrigated Acreage (million Ha)	1.70	-	-	2.10	-

SOURCE: REPELITA

[1] Amounts applied during growing season in prior year

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What follows is, unfortunately, neither a systematic nor an annotated bibliography. It is basically a listing of materials available in the files of the National Planning Agency that were helpful in putting together this paper, and the titles are mostly self-explanatory.

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I. On food production/marketing
II. Marketing of export-commodities
III. Land- and water- resources' use
IV. Institution building (mostly on cooperatives)
V. Statistical reporting

Rice Policy in Nepal

B. P. Dhital*

Introduction

Subsistence agriculture still predominates Nepal's economy. Approximately 88 percent of the population (total population estimated at 11.4 million in 1970) are engaged in agriculture. This sector accounts for about 66 percent (in 1968/69) of GDP and 85 percent of total export earnings. Rice, maize, wheat are the major foodgrains and such cash crops as jute, oilseed, sugarcane, tobacco are becoming increasingly important. These main foodgrains and cash crops are grown in the distinctive regions the high mountain regions and the plains of the Tarai. The Hills and mountains are intensively terraced in altitudes up to about 6,000 feet for the cultivation of paddy and up to 15,000 feet for other foodgrain production. Despite such intensive cultivation, however, the mountainous and hilly regions suffer from a food deficit due largely to the low productivity of the land and the high population density. The bulk of foodgrain is grown in the Tarai where land is relatively more fertile and the population density is much less, sharing only one third of the total population, while producing about two-thirds of the total crops in this country. This has enabled Tarai farmers to export some 300,000 metric tons of foodgrains annually to India. Marketing of Nepal's rice surplus has almost entirely depended on the rice balance conditions of India, inter alia, her adjacent States.

Land productivity differs significantly between regions. In the case of paddy, the Kathmandu Valley, the most advanced area in the country, produces nearly 3,500 kg./ha., while the average yield in other areas ranges from a high of 2, 840 kg./ha. in the eastern hills to a low of 1,640 kg/ha. in the western Tarai. The higher productivity of land in the hills should be mainly due to the food deficit situation there and to labour intensive cultivation while, in the Tarai where a food surplus exists, farmers lack the stimulus to intensive cultivation. The good crop harvest in recent years in adjoining States of India has given some unfavourable impact on Nepal's export price of rice.

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In the course of plan implementation during the past plan periods, Nepalese agriculture has experienced various difficulties. In addition to the shortage of financial resources, both domestic and external, factors such as modern administrative structure, the lack of basic economic statistical data, the shortage of well-trained administrators and technicians, notably, still embryonic stage of transport facilities have deterred rapid agricultural development. Consequently, major physical targets under the Plans have not been successfully fulfilled and economic growth rate remained at 2.3 percent on the annual average during the Third Plan period.

Paddy is by far most important foodgrain with its share in total foodgrains taking about 60 percent in value. Out of total foodgrains produced in 1969/70 (3.7 million M/T, paddy accounted for 2.4 million, followed by maize (0.92), wheat (0.24) and other cereals (0.15). Yield per ha. has varied slightly centering around 2.0 M/T for the last ten years. Considering still marginal proportion of area under HYV in total cropped area (the proportion accounting for only 3.7 percent, some 49,000 ha. in 1969/70). Basic factor inhibiting a rapid propagation of HYV is the back of availability of improved variety suitable to the area and a slow tempo of irrigation development which, by the end of 1969/70, is estimated to have reached 5-6 percent of the total cropped area. Taking into account the level and stage of technological, infrastractural and institutional preconditions necessary for the farmer to convert from subsistence rice cropping to market-oriented farming, the Nepalese farmer is still approaching the threshold of the "Green Revolution".

Current Government Rice Policy

During the past two decades, major effort of agricultural policy in Nepal has been concentrated in maximizing agricultural production and equitable distribution of its products, inter alia, foodgrains. During this period, population has increased approximately at the same rate as in foodgrain production, about 2 percent on the annual average. It is encouraging however that this rather stagnant trand of foodgrain production stepped up toward the end of 1960's, registering 2.7 percent on the annual average during Third Plan period. Major factor contributing to this was a sharp increase in wheat by 18 percent annually, mainly due to an expanded second cropping to paddy field and increased application of chemical fertilizers. As against this, paddy production increased only by 1.8 percent during the same period largely due to a severe setback affected by the droughts during the first two years of the Plan period.

Current Fourth Plan (1970/71-1974/75) succeeded previous Plan's objectives and policy lines in which maximization of food crop production was given top priority. Accordingly, agricultural sector takes a share of 33 percent in the total public sector development outlay of current Plan. Even then, this large share allocated to agricultural sector is by no means speculacular, considering the predominantly large population engaged in agriculture as well as the absolute size of development outlay of the HMG. Under such conditions, the target for annual average growth rate of paddy production has been set at the moderate rate of 2 percent in the current Plan. Since annual rate of population increase in this country for 1971-76 has been forecast at about 2 percent, the magnitude of rice surplus might remain constant. This surplus may even decrease, taking into account still high income elasticity of demand for rice and progressing urbanization.

Pattern of increased rice production strategies in recent years can be withessed in the expanded public sector activities for "quick yielding" modern inputs. For example, area under improved rice seeds increased from 6,331 ha. in 1965/66 to 49,000 ha. in 1969/70, while the seeds themselves also increased correspondingly from the negligible 171 M/T to 2,527 M/T in the same period. Tempo of the increase was considerable, still, as pointed out earlier, the absolute size of this improvement was still too small to give effective impact on aggregate rice production.

With the establishment of Agricultural Supply Corporation (ASC) in 1966, procurement of fertilizer was made from the world market on global tender basis and distribution channels were created in various districts of the Kingdom. In 1969/70, ASC supplied 4,600 M/T (in nutrients) of chemical fertilizers out of 4,900 M/T distributed in the country in the same year.

Distribution of agricultural inputs are still local and partial, though the coverage of ASC has been gradually expanded. For example, in 1966, 80 percent of the chemical fertilizer was consumed in Kathmandu Valley and the remaining 20 percent in and around Birgunj and Kalaiya districts. In the same year, out of the total chemical fertilizers consumed in Kathmandu Valley, 50 percent was used for paddy, 40 percent for b vegetables, and 10 percent for wheat, while in Birgunj, 10 percent was used for paddy, 80 percent for sugarcane, 8 pefcent for vegetables and 2 percent for wheat. Even in 1969/70, more than 60 percent of the total ~~chemi~~ chemical fertilizers consumed was used in the Kathmandu Valley alone. At present, except for improved seeds, for which the Government provides transportation cost subsidy, the distribution of the supplies is restricted to the Tarai Region, Kathmandu Valley and a couple of hill districts having transport facilities.

Constraints inhibiting proper and expanded propagation of modern inputs to paddy in Nepal are numerous. First of all, Nepalese farm households in general are economically extremely poor. Approximately $ US 66 is estimated as per caput agricultural GDP* for 1968/69. The 1961 Agricultural Census reveals that 46 percent of total agricultural households own a farmland of 0.15-0.50 ha., while 8 percent of the households having 3.0 ha. and above takes the share of nearly 40 percent of the total farmland. Also, literacy rate has been reported to have reached from 5 percent in 1951 to some 12 percent in 1970. It is therefore not exaggerating to say that more or less 95 percent of the farm households are still illiterate in this country. These are only partial examples of the basic factors limiting the economic and technological improvement of Nepal's rice farming.

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* Writer's estimate on the basis of data available at Central Bureau of Statistics, HMG, Nepal. On the assumption that the total agricultural population was 97 million in this year (88 percent of total), agricultural GDP at current price is estimated at 6,451 million rupees.

Basic research and experimentation for rice cropping with improved varieties are still new. Taiwanese rice varieties were introduced in the Kathmandu Valley in 1963. These varieties have given significantly higher yields than the local varieties. Similarly, IRRI rice varieties were introduced in 1968. The new varieties have yet to receive wider acceptance by the Nepalese farmers. It was only in 1954 that chemical fertilizers was first introduced, and annual average consumption between 1955 and 1965 was only 200 M/T in terms of plant nutrients. Even in 1969/70 when total cropped area was estimated at 2,185 thousand ha., per ha. doze of chemical fertilizer was no more than 2.2 kg., whereas the blanket doze of fertilizer recommended for cereal crops is about 60 kg. and 130 kg. per ha. for local and high yielding varisties, respectively. Therefore, even if half of the recommended dosage is applied in cropped areas having irrigation and some means of transportation facilities, then the annual rate of consumption of chemical fertilizers would go up several times higher than the present level of consumption. Assuming that present total cropped area remains constant and the HMG Plan target for increased fertilizer supply (25,000 M/T in 1974/75) fulfilled, per ha. fertilizer dosage will be some 12 kg., much higher than present 2.2 kg. Even this will exeed no more than one-fifth recommended for local varisties.

To support the farmer financially, ADB (Agricultural Development Bank) and LRSC (Land Reform Savings Corporation) are currently loaning credit to individual farmers and cooperatives. In 1969/70, the total loans extended reached Rs. 19.7 million (ADB for 5.9 million and LRSC for 13.8 million). Target of these two institutions for 1974/75 have been set at Rs. 155.5 million, which implies that each farm household gets on the average a sum of Rs. 84 in this year. Considering hawever the availability of financial resources to be newly sought after by the HMG, on the one hand, and the repayment capacity of the majority of the farmer, on the other hand, this rather ambitions target should require tremendous efforts to be fulfilled successfully.

Agricultural extension has been extensively in operation in combination with the provision of agricultural supply materials and credits as referred to earlier. Under the prevailing conditions in which majority of farmers are extremely poor economically with a high rate of illiteracy, tasks assigned to the extension workers are tremendous. Extention programme in Nepal took a moderate shape in 1959. By the end of 1963, there were 55 districts out of 75 which were covered by extension activities. So far by 1969/70 the total number of extension workers had been increased to: 43 District Agricultural Development Officers, 90 Junior Technicians and 700 JTAs (Junior technical assistant with high school graduate level). It is very difficult to identify the degree of impact these workers have given, because this "catalyst" of agricultural modernization should be effective only when many other essential factors are combined toward common goal, in time, in quantity and in quality. Apart from evaluating overall activities of the combined factors, it may be worthy of pointing that, in spite of untiring efforts, technical capability and experiences of many of JTAs have been still inadequate to convince the farmer to adopt new methods of rice cropping. Lack of concomitant support in guaranteeing equitable and stabilized market conditions on behalf of the farmer was one of the serious weaknesses in this point.

Grain handling, storage, and processing facilities at the farm level and primary and secondary assembly points are primitive and result in excessive losses. Field tests in Nepal show that hand-pounding or the huller-type rice mill, typical of village rice milling, recover 52 to 55 kg. of rice from 100 kg. of dry paddy. The huller-type rice mill, typical of commercial operations in the Tarai, recovers 56 to 60 kg. of rice when raw rice is processed and 60 to 63 kg. when parboiled rice is processed. Reasonalbe standards would be 65 to 67 percent recovery while the most modern techniques should yield 68 to 70 percent rice recovery rates. In addition, losses due to excess moisture, rodents and insects may exceed an estimated 14 percent in the Mountain regions and 12 percent in the Tarai for paddy stored more than six months.

In spite of an increasing recognition for acute need for improving these conditions, HMG has not been able to exercise any strong policy measure mainly due to financial and technical difficulties. Only exception is the role being played by Food Management Corporation, a non-profit Governmental organization, which is to achieve balanced and stabilized distribution of rice in this country. Its actual activities are however limited to stabilizing market prices of rice in the Kathmandu Valley alone and in favour of public institutions and the consumers. This Corporation purchases rice mainly in Tarai from rice dealers (mainly rice millers) in the post-harvest season when the rice price is lowest. Payment to the dealers is made six months in advance, its advance payment being 75 percent of the sum to be paid for the purchase. In the last few years, average purchase price of rice by the Corporation was Rs.42-43 per mound (1 mound equals 37.3 kg.) as against then prevailing market price of Rs. 45 at the post-harvest time. It means that the Corporation buys it Rs. 2-3 cheaper than the lowest market price. It is evident that this system functions in favour of the Kathmandu consumers. The Corporation issues the stocked rice to Kathmandu Valley in the preharvest season when rice prices are highest. In the light of rising prices of rice in recent months (Rs. 60 in retail price per mound, medium-grade as compared to Rs. 50 two years ago) in the Valley, the price stabilizing mechanism of the Corporation appears not to be properly functioning. In 1969/70, the Corporation released its rice of some 71 thousand M/T.

In the face of the declining trend of export prices of rice to India during the last two years, HMG has been paying a more serious attention to improved marketing conditions, domestic as well as overseas. As one of the countermeasures, HMG has embodied in its Fourth Plan the establishment of a Marketing and Warehousing Corporation. In the preliminary stage, this corporation will expand external market of agricultural products and provide facilities to the farmers for storage for a given period of time. On the basis of agricultural products thus stored, farmers could get required credit from Agricultural Development Bank and Land Reform Savings Corporation and could sell their products when market conditions are favourable to them.

Major Policy Problems in the Short and Long Run

Rice is the staple foodgrain in Nepal. Of the total cultivated area of 2.185 million hectares, nearly 63 per cent is under rice cultivation. The consumption pattern of rice differs from region to region because of the regional variation in production and the unintegrated nature of the internal market. The Tarai (plain) region produces nearly 83 per cent of the total rice produced in the country. The averal annual per capita consumption of cereals in the Hills and Tarai comes to about 120 kg. and 190 kg. respectively. Of this, 60 kg. in the Hills and 171 kg. in the Tarai is rice. Although the consumption of maize, wheat, millets and barley is substantial in the Hills, their share in the Tarai is marginal. However, the people in the Tarai are gradually increasing the consumption of wheat as the production rate of wheat has been significantly increasing in the last 4-5 years.

The demand for rice will continue to expand in the next 5 to 10 years. The total population is estimated to grow by 2.2 per cent reaching 12.7 million people by 1975 from 11.4 million in 1970. The present distribution of population between the Hills and Tarai of 64 per cent and 36 per cent is estimated to be changed to 60 per cent in the Hills and 40 per cent in the Tarai by 1975 as a result of migration from the Hills and resettlement programs in the Tarai. If this happens there will be 7.6 million people in the Hills and 5.1 million people in the Tarai. The annual population growth will be about 1.2 per cent in the Hills and 4.1 per cent in the Tarai. Assuming per capita income growth in the Hills 1.3 and in the Tarai 2.0 (based on the Fourth Plan, 1970-75, estimate of 4 per cent annual growth in the national income) and the income elasticity of demand for rice to be 0.60 in the Hills and 0.10 in the Tarai, the demand for rice will increase annually by 1.98 per cent in the Hills and 4.3 per cent in the Tarai. Assuming the present consumption pattern of 50 per cent in the Hills and 90 per cent in the Tarai of rice in the total cereal consumption, the total additional requirement of rice by 1975 will come to about 0.215 million M/T. The Fourth Plan envisages to produce an additional amount of 0.118 million M/T of rice, There will be a deficit of 0.097 million M/T of rice, which will have to be met by reducing the export and/or by substituting with other cereals.

Considering the importance of rice in the economy of Nepal both from the point of local consumption and export earnings, Nepal's rice policy, unlike in relatively more advanced developing countries of Asia, has been to struggle on two fronts. Firstly, the production has to be increased with meagre financial and technical resources available with the Government, as it is not easy to shift production to other crops in the short run. Secondly, it has to face export markets, which are becoming more selective in quality, with its traditional crop.

Economic rationale of rice policy would be to strike out, among equally important measures, basic price lists equitable and acceptable both by the consumer and the producer. In many Asian countries where rice is the mainstay of agricultural economy, rice price policy has been, and still is, crux and core of agricultural problem. In many cases however, this price policy in these countries was evolved and developed during the period of acute food shortage. In some other countries where the export of large quantities of rice surplus, was their major concern, policy preoccupation was in increased export proceeds, hence increased Government revenue.

Rice price policy which requires sophiscated justification and technique has not been introduced into Nepal. Under the present conditions of subsistence agriculture, price mechanism does not properly function. It is understood that there must be reliable statistical data on rice before the Government intervenes or participate in such strategies. For example, one of the most essential data such as wholesale or farmgate price series are still not available for the country as a whole in Nepal. The Central Bureau of Statistics and the Rastra Bank collect and publish a time series of prices paid by consumers for a number of items. An extensive farm management survey conducted by Economic Analysis and Planning Division in 1969/70 will fill out partially this statistical vacuum.

Assuming that farmgate prices are near a constant proportion of retail rices over time, then the price of wheat (flour) relative to rice or potato favoured the increased allocation of resources to wheat production starting in 1964/65. Also as a substitute for rice, relative prices favoured an increase in potato production. Also, it is generally believed that wholesale prices for rice at Tarai markets are a function of nearby Indian wholesale market prices, adjusted downward for transport, handling and other marketing costs; also, that prices in the various Mountain market centres for commodities "imported" from the Tarai surplus production areas represent the Tarai wholesale price plus these costs. In this way, Nepalese rice economy has been, so far as its prices are concerned, greatly influenced by the rice balance position in the adjoining Indian States. It may be part of the reasons that HMG has found it very difficult to propose rice price policy of any kind.

Nepal is however ecountering a new demension of rice economy. First of all, "Green Revolution" now spreading in India may reduce or even quit importing rice from this country in the near future. Anticipation of future balance picture of Nepalese rice is very difficult for two main reasons: deficiency of data necessary to forecast for domestic demand and supply of rice; second, since Tarai Region still heavily depends on the neighbouring states of India for the disposal of its surplus, the Region's rice position will be determined at least by the rice balance of these States unless positive policy measures are taken domestically.

Assuming that these Indian States attain self-sufficiency in the near future, Nepalese farmers should accelerate the diversification of cropping pattern away from rice-centred to other products of agriculture. However, the diversification of cropping pattern is subject to the farmer's strong resistance unless some incentives or guarantees are ansured, as the experiences of some Asian countries including Japan show. In the short-run perspective, under the same assumption, a wider range of rice distribution from the Tarai to the Mountain and Hilly regions should be evolved. In the long run, regional (domestic) division of labour should be formulated so as to enable the farmer of each region to take a full advantage of producing and marketing his products. This comparative advantage within the country of different commodities between different regions should also be examined vis-a-vis those in the adjoining Indian States.

Possibilities of creating new opportunities for marketing such goods should not be limited to this framework. Such international commodities as jute, cotton, sugarcane, in the Tarai and fruits, animal products in the Hills should have ample opportunities for the Mountain and Hilly farmers to sell in exchange for rice which is physically difficult to grow more there. To carry out these proposed reallocation of resources on the national scale is, at this stage of economic development, next to impossible for HMG at least financially. Immediate measures to be taken for Nepalese rice economy should be to continue increasing improved rice cropping, to develop marketing and transport facilities, with equal regard for standardizing and improving quality of rice so that the consumer as well as producer enjoy equitable price on the national basis, while hastening to prepare adequate data supporting sound medium and long-term projection of the balance of agricultural commodities including rice.

Table 1. Agricultural Production

(1964/65-1969/70)

A: Area: 000ha.
P: Prod: 000M/T

Cereals		1964/65	1965/66	1966/67	1967/68	1968/69	1969/70	Growth Rate of Prod.% 5 year ann. average.	Growth rate % in 1969/70 over 1968/69
Paddy	P	2201	2207	2007	2217	2322	2410	1.81	3.87
	A	1111	1111	1100	1130	1139	1325		
Wheat	P	126	147	159	190	227	242	16.41	6.44
	A		118	126	150	173	195		
Maize	P	855	856	824	875	900	920	1.52	2.25
	A		451	450	434	450	540		
Barley	P	26	26	28	26	29	29	2.30	0.0
	A		27	27	25	26	27		
Millet	P	63	120	120	112	111	116	16.82	4.50
	A		100	100	93	94	98		
Total	P	3270	3358	3138	3420	3589	3717	2.73	3.61
Cash Crops									
Potato	P	286	277	300	315	295	292	0.41	0.80
	A		42	43	43	43	46		
Sugar cane	P	126	192	147	167	188	199	11.56	5.72
	A		13	10	11	12	13		
Oilseeds	P	51	51	56	56	57	60	3.52	4.92
	A		96	98	94	98	99		
Tobacco	P	9	9	5	5	6	6	6.66	0.0
	A		8	8	8	8	8		
Jute	P	39	39	38	40	40	48	4.61	9.00
	A		32	32	37	38	40		

Source: Prepared by Economic Analysis and Planning Division, Ministry of Food and Agriculture, HMG, Nepal.

Table 2. Targets and Achievements in Agricultural Inputs (1965/66-1969/70)

Programs	units	Targets of 3rd Plan	1965/66	1966/67	1967/68	1968/69	1969/70	Growth rate of 4-year ann. av. %	% of target	Growth rate of 1969/70
1. Area under improved seeds	ha.	800,000	10,754	25,993	57,303	102,630	211,700	467.1	26.5	106.3
2. Paddy		...	6,331	13,492	26,068	42,552	49,300	414 .6		146.8
Wheat		...	4,326	11,371	28,027	53,773	90,000	495.1		67.4
Maize		...	97	1,209	3,208	6,303	16,700	4304.1		265.0
3. Use of Chemical fertillizer (gross)	m/t	221,000	3,169	6,670	16,000	24,000	29,091	229.5	13.2	5.3
4. Reclaimed Land	ha.	13,900	804	2,801	3,875	4,931	5,363	166.8	38.6	2.2
5. Resettled families	no.	6,000	800	1,378	1,915	1,936	2,103	65.7	35.1	8.6
6. Irrigation	ha.	148,000	6,000	25,000	12,850	15,240	—	—	39.9	

Note: Rate of Achievement at the end of 1968/69.

Source: Prepared by Economic Analysis and Planning Division, Ministry of Food and Agriculture, HMG, Nepal.

Table-3. Area Planted to Rice and Other Crops in Nepal. 1969-70

'000 hectares.

	Main crop	2nd crop	Total
Total cultivated hectares	2061	290	2351
Total irrigated hectares	103		103
Effective crop area[a]	2556	348	2904
Land in rice			
irrigated			103
rainfall			920
upland			302
Total:-			1325
Total land in HYV.			139
land in paddy			50
land in wheat			75
land in corn			11
land in other foodgrains			3

a. Sum of irrigated and non-irrigated single and double cropped land. Double cropped land counts as 2 hectares.

Table-4. Current Factor and Product prices in 1969-70.

	Tarai	Country
Price of rough paddy/kg.	Rs. 0.90	Rs. 1.00
Price of nitrogen/kg.	,, 3.50	,, 4.15
Institutional credit rate/year	,, 10 p.c.	10 p.c.
Wage for farm hired labor/day	Rs. 4.00	3.75
Land value-single crop irrigated paddy/ha.	,, 5,000	8,000
Irrigation fee/hectare/crop (rice only)	,, 10	10
Rental sharing arrangements for tenants		

Output: Half of the main produce
Inputs: All by tenant except land revenue tax

Exchange Rate US $ 1 = 10.10 Nepalese Rupees.

Table 5. Rice Exports from Nepal

Quantity: 000M/T
Index : Base Year 1964-65

Year	Rice	Paddy	Total Rice	Index
1958/59	38	54	71	58
1959/60	67	45	94	77
1960/61	79	61	116	95
1961/62	85	55	118	97
1962/63	64	39	88	72
1963/64	174	41	99	81
1964/65	107	26	122	100
1965/66	44	11	50	41
1966/67	116	18	122	100
1967/68	81	17	91	74
1968/69	92	15	102	83

Note : Paddy Converted into Rice at the rate of 60 % recovery. Preliminery Estimats.

Source : Economic Analysis and Planning Division,
MFA, HMG, Nepal.

Rice Cost of Production in Vietnam - 1968/69 Rice Crop and Preliminary Estimates for 1970

R. S. Fox *

Preface

This report presents information on costs and related input requirements of Vietnamese rice producers. The data presented are the result of a cooperative effort of the Agricultural Economics and Statistics Service (AESS) of the Vietnamese Ministry of Land Reform, Agriculture and Fishery Development and several USAID/ADFA agricultural economists and statisticians. AESS, with USAID assistance, designed and conducted the rice costs of production survey from which this report was prepared.

Introduction

The recent introduction of improved rice production technology necessitates the need for up-to-date information which can be used for decision making activities at the national, regional, local and farm level. The significant price adjustments within the economy, which are and have been and are likely to continue for some time, also heighten the need for revision of available knowledge. This survey was an attempt by AESS to provide this information as it relates to rice production.

It is intended that this be one of numerous cost of production studies to be conducted on various enterprises of the agricultural sector. The overwhelming prominence of rice in the Vietnamese agricultural sector required that this area be investigated first. However, as rice self-sufficiency approaches realization comparative production costs for supplementary, complementary and competitive agricultural enterprises must be known if rational policy and producer decisions are to be made.

Objectives

The objectives of this survey and resultant analysis were to: (1) quantity input requirements by region and farm size for the various types of cultural practices being used by Vietnamese rice producers; (2) estimate costs and returns to operators under past and current price relationships; (3) organize and present a method of analysis which can be used as an aid to both national and farm planners and, as more cost studies become available, provide the basis for projecting potential incomes from alternative crops.

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PROCEDURES AND METHODS OF ANALYSIS

A. The Survey Sample: A 703 farm random sample was developed as a means of acquiring production cost data. The sample was stratified by; (1) two regions - Coastal Lowlands and Southern Region; (2) four farm sizes; and (3) four cultural practices - single transplant, double transplant, broadcast floating rice and broadcast non-floating rice. Averages were then to be computed to provide a basis for "constructing" rice farms of selected size and cultural practice.

The complexity of the questionnaire combined with limited enumerator skills resulted in only 260 useable schedules. As a result of the diminution of the sample it must be realized that randomness and therefore representativeness has undoubtedly been lost. Also, because of this reduced sample size it has become impossible to measure the effects of farm size on production costs. Thus, the data presented in the annex of different farm sizes within a given cultural practice assumes no economies of scale. This of course is not a valid assumption where the opportunity costs of family labor are about zero. In that case family labor would have to be treated as a fixed cost to be allocated on a per unit basis which would decrease with increased farm size. The unit cost of livestock power, if owned, would also decline with increased farm size. Of the farms in the survey 1 percent used owned livestock power only, 67 percent hired their livestock power and 32 percent used both owned and hired livestock power.

1. Cultural Practices - Cultural practices of rice producers vary with drainage capability, surface water depth during the monsoon season and custom. In this study production cost estimates were made for the following cultural practices.

a. Single transplant rice: This method of rice cultivation is practiced in most of Vietnam with the exception of those Delta provinces adjacent to Cambodia and the areas of the central Delta where floating rice is grown and double transplanting is practiced respectively. The seeds are sown in a seed bed and the seedlings are later transplanted into a puddled field (paddy) from 20 to 40 days later. The cost of transplanting represents from 30 to 35 percent of total labor costs.

b. Broadcast non-floating rice: This limited practice is followed in the same geographical areas as single transplanting. The seed, however, is sown directly into a puddled paddy and weeding and water control procedures are used during the growing period.

c. Double transplant rice: This cultural technique of the central Delta is probably practiced as a weed control device since weeding as such is not practiced. The seed is sown in a seedbed and the seedlings later transplanted to a larger plot (expanded by about 1/10) where they remain until the seedlings are stooling. At this time the second transplanting into the flooded field is performed. There is very little tillage of the soil. Field preparation is primarily one of vegetation removal either by pulling and/or with the use of a sickle. This is a very high labor intensive method of rice production.

d. Broadcast floating rice: The rice seed is sown onto a plowed field at the beginning of the rainy season. With the exception of a limited amount of weeding the farmer pays very little attention to the crop during the growth period. The floating rice varieties grow rapidly and are able to survive in relatively deep waters that are endemic to the provinces of the western Delta.

2. Regional Stratification - Rice producers were enumerated in the following provinces.

a. Coastal Lowlands:

(1) Phu-Yen
(2) Quang-Ngai

b. Southern Region:

(1) An-Giang
(2) Ba-Xuyen
(3) Dinh-Tuong
(4) Gia-Dinh
(5) Long-An
(6) Phong-Dinh
(7) Sa-Dec

The regional breakdown is one of the Delta (Southern Region) and other. Here Delta refers to the area flooded by the Mekong river and its branches and tributaries. About 80 percent of the rice grown in South Vietnam is produced in this area.

The Coastal Lowlands refers to those coastal provinces of South Vietnam which are north of Saigon. It represents a heterogeneous area which extends in a north-south direction for about 375 miles. Only two of the 10 provinces of this region were included in the study and it should be remembered that significant differences within the region are likely to exist.

B. Analysis: After the survey had been completed it was decided to use USAID's automatic data processing facilities as a means of expediting the summarization. Since this was an after-thought the questionnaires had not been constructed with the guidance of a systems analyst. Thus the data was not in a form readily adaptable to card punching. The result was one of considerable delay in preparing the data for computer input; lax in editing of the questionnaires, and resultant numerous computer runs were necessary until a useable print out become available.

1. Farm Characteristics - Tables 1 through 4 provide a picture of the make-up of the survey sample farms. Table 1 indicates simple averages of farm size, production and paddy utilization by region, cultural practices and land ownership. It is interesting to note that the largest farm operations, on the average, were in the land "owned and rented" category. Table 2 shows this same basic data on a per hectare basis. Tables 3 and 4 are frequency distributions by farm size of the floating and single transplanting rice farms of the sample.

Tables 5 through 10 are data in terms of piasters of the costs and returns to rice producers by region and cultural practices in 1968 and

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preliminary 1970 prices. Tables 11 and 12 estimate the cash needs of improved technology rice producers at selected foreign exchange rates.

2. Cost components: Draft Power - An attempt was made to acquire data on the cost of owning and operating both tractors and draft animals. In the case of tractors practically all farmers included in the sample who used tractors had their land tilled with hired equipment. The data acquired on the cost and maintenance of draft animals was extremely sparce and of no significance. As indicated earlier a significant part of the land was prepared with the use of hired draft animals. Under the circumstances it seems to be appropriate to use the hire rate for both tractors and draft animals to estimate the cost of land preparation.

Labor - Job specialization, with local variation, is being practiced by Vietnamese rice producers. That is some activities are performed by women and others by men. Transplanting, weeding, reaping and paddy drying are generally considered womens work. Land preparation, water control, insecticide and fertilizer application, threshing and transporting the paddy home are performed primarily by men. In this report to compensate for lower wages paid to women total man work days (MWD) were estimated by applying a factor of 0.75 to women work days and added to the MWD. Wage rates also differ within the men and/or woman category for the various tasks of producing rice.

Seed - Seed inputs varied by cultural practice. About 120 kilograms of seed per hectare was used for broadcasting and 45 kilograms per hectare by farmers using the transplanting technique.

Fertilizer - An attempt was made to identify the response of rice to fertilizer. Using the sample survey data for the 1968/69 rice crop and the preliminary data from two of the 11 provinces surveyed in 1970, two linear correlation equations were computed (charts 1A, 2A). The result was a response coefficient for local rice varieties (non-floating) of 2.54 at a mean fertilizer application rate of 192 kilograms (50 percent urea and 50 percent 16-16-8) per hectare and a paddy yield of 2,594 kilograms.[1/] With TN varieties the response coefficient was 3.65 at a mean fertilizer application rate of 322 kilograms (30 percent urea and 70 percent 16-16-8) and a paddy yield of 4,475 kilograms.

In both cases the coefficient of determination (r^2) was very low reflecting other factors such as varietal differences, soil characteristics, different application ratios of N-P-K, timely application of insecticides and fertilizer, weeding and other management practices. Thus, these equations provide little insight for making recommendations at the micro level since local factors have not been isolated for additional analysis. However, on

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[1/] In terms of production this means that an additional kilogram of fertilizer will produce 2.54 kilograms of paddy.

a macro basis it does provide an indication as to what yields might be expected if the mean or near mean indicated cultural techniques were extended to areas similar to those included in this survey.

Insecticides - No effort was made to identify the response of rice to insecticides. The insecticides being used by sample farmers were primarily those farmers who were also using fertilizer. Therefore, the response to insecticides has been incorporated into the fertilizer analysis.

Implication

A. Policy - The survey data on production costs have been summarized in a manner which will make it possible for individuals with varying interests to select those cost factors that are useful to them. Interested parties include rice producers, government officials, lending institutions and manufacturers and distributors of agricultural inputs and products. Government officials normally would consider the full cost of production, including returns to land and management as well as a "normal profit". They may also consider a concept of "equitable farm family income" that would include returns to family labor and also returns to land if the level of tenancy were low. On the other hand farmers, at least in the short run, are more likely to consider only cash outlays in developing their production plans.

To the individual farmer variable costs are generally those input costs which require cash outlays at the time of their utilization. They include fertilizer, insecticide, seed and hired labor.

Hired labor is used primarily at the time of transplanting and harvesting. At these two peak labor requirement periods timeliness necessitates that a significant proportion of these two tasks be accomplished by non-farm family labor. Per hectare hired labor requirement may run as high as VN$4,500 for single transplant rice to as low as VN$3,000 for floating rice. However, cash outlays are necessary only for the transplanting period since hired labor for harvesting is generally paid for with paddy. Thus, hired labor for transplanting and land preparation cost, if hired draft power is utilized, are the primary cash outlays for traditional rice production techniques.

1. Risk Factor - For farms using improved rice production technology cash outlays increase significantly with the purchase of fertilizer and insecticides. Although these higher cash expenditures increase the potential for greater producer incomes they also increase the loss potential if there is a crop failure. For local variety rice producers (Southern Region) using improved technology 48 percent of cash outlays are due to fertilizer and insecticides (Table 11). For TN varieties 54 percent of the cash outlays are due to fertilizer and insecticide inputs. In an economy where money is a relatively scarce resource as it is in rural Vietnam the shift to new technology presents a real risk to those farmers who must borrow money to meet their cash needs at planting time. In many areas of Vietnam risk is magnified considerably by such factors as illegal taxing, mechanical destruction of the rice crop due to military action or actual loss of life to hostile actions. This risk

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is considered as an added cost by farmer who are contemplating cash expenditures or technological innovation.

2. Foreign Exchange Rates - Fertilizer and insecticides are being imported into Vietnam at an effective exchange rate of VN$118 to US$1 (exchange rate of VN$80 to US$1 plus a VN$38 tax). What would be the effect of increasing the exchange rate to VN$275?

The immediate effect would be an increase in the cash outlay for fertilizer and insecticides by rice producers of from 65 to 70 percent assuming no decline in rates of application (Table 11). These increased costs would add about 18 percent to the costs per kilogram of producing rice. It would reduce the marginal returns of fertilizer from 4.54 to 1.94 for local rice varieties. For TN varieties the marginal returns for fertilizer would decline from 7.00 to 3.00. This undoubtedly would restrict fertilizer inputs on local rice varieties and when considering the risk factor a marginal return on TN varieties of 3.00 might also limit or prevent the expansion of area devoted to these high yielding varieties. If the marginal returns to fertilizer at the mean rate of application indicated in Chart 2A for TN varieties were to be maintained at 4.00 under an exchange rate of VN$275, paddy would have to sell at a price of about VN$30 per kilogram. This of course assumes that the mean fertilizer application rate indicated in chart 2A is a point on the rice/fertilizer production function that is increasing at a decreasing rate. If this were not the case producers could increase their marginal returns to fertilizer by increasing their rate of application.

3. Family Income - The survey did not acquire total family farm income data as such. However, that part of farm family income which resulted from their rice production enterprises can be estimated. This estimated income will vary with farm size, rate of double cropping and the number of farm workers per family.

In addition to the "Returns to Management" indicated in the attached tables, there is also a part of the labor costs that can be attributed to family income. On farms of 1 to 2 hectares, from 20 to 30 percent of the labor for a single crop for transplanting and harvesting and about 100 percent of other [illegible] costs can be considered as family income. Since labor requirements for [illegible]anting and harvesting go beyond that which can be supplied by the farm [illegible], family incomes increase at something less than an arithmetic rate with increased farm size. This is not the case however of a farm with double cropping capability. A one hectare farm producing two rice crops annually on the same area should double family income assuming production costs and yields are equal for both crops. Also if the farm operator is the owner of the rice land, the cost of "Rent on Land" is considered as part of the family income.

The question as to what an equitable family income should be a sociological and not an economic one. However, it should be remembered that if rural stability is to be established farmers must have sufficient incomes to participate in the consumer economy which has developed so rapidly in the urban areas of Vietnam.

One other factor that must also be considered is that a large number of farms are less than one hectare in size. In the Southern Region about 22 percent of the farms are less than one hectare. While in the Central Lowlands the farms under one hectare represent 75 percent of all farms. However, the rate of double cropping is greater in the Central Lowlands which somewhat increases the "effective" farm size.

Frequency Distribution of Paddy Farms by Farm Size and Region, 1960-61 Agricultural Census, Vietnam.

Farm Size	18 Provinces of Southern Region	9 Provinces of Central Lowlands
	%	%
Less than 0.5 ha.	5.68	43.27
0.5 ha. to 0.9 ha.	16.18	31.73
1.0 ha. to 1.9 ha.	33.86	19.03
2.0 ha. to 2.9 ha.	18.49	3.86
3.0 ha. to 4.9 ha.	15.67	1.59
5.0 ha. and over	10.12	0.52
	100.00	100.00

Source: Report on the Agricultural Census of Vietnam, 1960-61, Agricultural Economics and Statistics Service.

B. Continued Study - Acquiring production costs requires a relatively complex questionnaire. Because of this and the use of unskilled enumerators a considerable proportion of the questionnaires were unuseable from the 1968/69 rice crop survey. In future studies of this nature I would suggest that AESS, as they are currently doing on TN rice varieties, carefully select farmers for enumeration and not attempt to develop a random sample. By selecting a small number of farmers in selected provinces AESS fieldmen will be able to do the interviewing which whould provide data that is comparable from region to region and thus more readily additive. The smaller sample would also lend itself to relatively quick hand tabulation making the information available on a more timely basis.

Information on the response of rice to various levels and combinations of fertilizer (N-P-K) by variety, soil types and location is still very much an unknown entity. If this information and a soil survey map were available recommendations to farmers could be made as well as an estimate of the production potential for land on a national basis. Assuming that farmers apply N-P-K at different levels and ratios, fertilizer/rice production functions by region could be estimated. Information could be gathered during the annual survey on the amount of N-P-K used on rice and related yields, whether or not pesticides were applied and if growing conditions were "normal". Using multiple correlation techniques an equation of three independent variables (N-P-K) could be estimated. If the data would lend itself to developing a production function for fertilizer, optimum rates of N-P-K application could be estimated for a given set of price relationship.

Table 1. Farm Characteristics: Survey Averages of Area, Production and Utilization of Paddy - Rice Cost of Production Survey, 1968/69 Crop.

Number of Farms Averaged		Total area (ha.)	Area harvested (ha.)	Paddy production (kgs.)	Paddy Utilization					
					Sale (kgs)	Labor (kgs)	Rent (kgs)	Home (kgs)	Seed (kgs)	Feed (kgs)
	Southern Region									
87	Floating (Broadcast)	3.81	3.74	5,641	1,533	1,247	732	1,414	446	269
35	Owned only	3.93	3.87	5,507	2,063	1,047	-	1,611	501	285
44	Rented only	2.89	2.85	4,417	769	939	990	1,182	326	211
3	Owned and rented	8.32	8.02	12,950	3,418	3,818	2,512	1,825	862	515
35	Broadcast (non-floating)	1.66	1.57	3,404	1,121	174	270	1,509	197	129
14	Owned only	1.23	1.22	2,931	936	79	-	1,607	136	173
17	Rented only	1.36	1.18	2,619	672	106	338	1,289	152	53
4	Owned and rented	4.48	4.42	8,400	3,675	800	925	2,100	600	300
18	Double Transplant	1.60	1.52	3,232	503	457	286	1,774	42	170
2	Owned only	0.85	0.75	2,100	600	100	-	1,200	50	150
16	Rented only	1.69	1.62	3,374	491	502	322	1,846	41	172
0	Owned and rented	-	-	-	-	-	-	-	-	-
113	Single Transplant[1/]	2.00	2.05	4,201	1,521	233	386	1,515	86	460
33	Owned only	1.87	1.95	3,985	1,694	315	-	1,456	89	431
69	Rented only	1.84	1.90	3,990	1,233	171	521	1,487	75	503
11	Owned and rented	3.45	3.29	6,168	2,804	373	698	1,866	145	282
	Coastal Lowlands									
29	Single Transplant[2/]	1.11	1.11	3,214	1,019	634	62	1,406	72	21

1/ 5.5% of total area planted was double cropped in rice. Includes 10 TN-8 farmers, six of which produced a second-crop.

2/ 37.8% of total area planted was double cropped in rice. Only one hectare of the total was rented.

Table 2. Farm characteristics: Paddy production and utilization on a per hectare basis - rice cost of production survey, 1968/69 crop.

Number of Farms		Total Area		Paddy production (kgs.)	Paddy Utilization					
		Planted (ha.)	Harvested %		Sale (kgs)	Labor (kgs)	Rent (kgs)	Home (kgs)	Seed (kgs)	Feed (kgs)
	Southern Region									
87	Floating (Broadcast)	1.0	98.2	1,480	402	327	192	371	117	71
35	Owned only	1.0	98.5	1,400	525	266	-	410	127	72
44	Rented only	1.0	98.6	1,527	266	324	342	409	113	73
8	Owned and rented	1.0	96.4	1,556	410	459	302	219	104	62
35	Broadcast (non-floating)	1.0	94.3	2,045	674	105	162	907	118	79
14	Owned only	1.0	99.4	2,385	762	64	-	1,308	110	141
17	Rented only	1.0	87.0	1,919	494	78	248	948	112	39
4	Owned and rented	1.0	98.9	1,877	821	179	207	469	134	67
18	Double Transplant	1.0	95.5	2,021	315	286	179	1,109	26	106
2	Owned only	1.0	88.2	2,471	706	118	-	1,412	59	176
16	Rented only	1.0	95.9	1,993	290	297	190	1,090	24	102
0	Owned and rented	-	-	-	-	-	-	-	-	-
113	Single Transplant	1.0	97.3	1,900	689	105	174	685	39	208
33	Owned only	1.0	96.4	1,973	839	156	-	721	44	213
69	Rented only	1.0	92.2	1,895	586	81	247	706	36	239
11	Owned and rented	1.0	95.5	1,791	814	108	203	542	42	82
	Coastal Lowlands									
29	Single Transplant	1.0	100.0	2,895	918	571	56	1,266	65	19

Table 3. Southern Region: Frequency distribution of survey sample of floating rice farms by farm size.

Farm size	Number of farms	Percent
Less than 0.5 ha.	6	6.9
0.5 ha. to 0.9 ha.	8	9.2
1.0 ha. to 2.0 ha.	20	23.0
2.0 ha. to 3.9 ha.	19	21.8
4.0 ha. to 7.9 ha.	22	25.3
8.0 ha. and over	12	13.8
Total	87	100.0

Table 4. Frequency distribution of survey sample of single transplant farms by farm size.

Farm size	Number of farms	Percent
Less than 0.5 ha.	4	3.5
0.5 ha. to 0.9 ha.	12	10.6
1.0 ha. to 1.4 ha.	36	31.9
1.5 ha. to 2.4 ha.	31	27.5
2.5 ha. to 4.9 ha.	18	15.9
5.0 ha. and over	12	10.6
Total	113	100.0

Table 5. Southern Region: Comparative cost and returns of rice producers on a hectare basis by cultural practice, using traditional technology - 1968 prices.

	Broadcast		Double	Single
	Floating	Non-floating	transplant	transplant
	------------------------ VN$	------------------------	------------------------	------------------------
Costs				
Land preparation	2,850	3,420	-	3,850
Labor	4,425	4,390	17,250	11,660
Seed	1,800	1,680	760	680
Rent on land	5,400	3,780	3,400	4,200
Interest	405	480	1,120	960
Total Cost	14,880	13,750	22,530	21,350
Cost per kilograms (Paddy)	9.92	7.64	11.26	11.24
Returns (Gross)				
Paddy (MT)	1.50	1.80	2.00	1.90
VN$	27,000	25,200	34,000	28,500
Returns to Management	12,120	11,450	11,470	7,150
Paddy Price	18	14	17	15

Table 6. Southern Region: Comparative costs and returns of rice producers on a hectare basis by cultural practice, using traditional technology - 1970 prices.

	Broadcast		Double	Single
	Floating	Non-floating	transplant	transplant
	VN$			
Costs				
Land preparation	4,500	5,400	-	6,200
Labor	6,255	9,020	26,530	19,340
Seed	2,400	2,760	1,035	1,035
Rent on land	6,000	6,210	4,600	6,440
Interest	600	760	1,600	1,520
Total Cost	19,755	24,150	33,765	34,535
Cost Per Kilogram (Paddy)	13.17	13.41	16.88	18.18
Returns (Gross)				
Paddy (MT)	1.50	1.80	2.00	1.90
VN$	30,000	41,400	46,000	43,700
Returns to Management	10,245	17,250	12,235	9,165
Paddy Price	20	23	23	23

Note: Prices used to formulate this table are preliminary.

Table 7. Southern Region: Comparative costs and returns of rice producers on a hectare basis by cultural practice, using improved technology - 1968 prices.

	Broadcast Non-floating	Single transplant Local varieties	Single transplant TN varieties
	VN$		
Costs			
Land preparation	3,420	3,850	3,850
Labor	5,390	12,990	14,600
Seed	1,680	675	675
Insecticide	3,250	3,250	3,250
Fertilizer	1,430	1,710	2,970
Rent on land	5,040	5,850	10,125
Interest	920	1,440	1,600
Total cost	21,130	29,765	37,070
Cost per kilogram (paddy)	8.80	11.06	8.24
Returns (Gross)			
Paddy (MT)	2.40	2.60	4.50
VN$	33,600	39,000	67,500
Returns to Management	12,470	10,235	30,430
Paddy Price	14	15	15

Table 8. Southern Region: Comparative costs and returns of single transplant rice producers on a hectare basis, using improved technology - 1970 prices.

	Broadcast Non-floating	Single transplant	
		Local varieties	TN varieties
	- - - - - - - - - - - -	VN$	- - - - - - - -
Costs			
Land preparation	5,400	6,200	6,200
Labor	11,270	21,805	24,680
Seed	2,760	1,035	1,035
Insecticide	3,860	3,860	3,860
Fertilizer	1,560	2,280	3,960
Rent on land	8,280	8,970	15,525
Interest	1,320	2,160	2,400
Total cost	34,450	46,310	57,660
Cost per kilogram (paddy)	14.35	17.81	12.81
Returns (Gross)			
Paddy (MT)	2.40	2.60	4.50
VN$	55,200	59,800	103,500
Returns to Management	20,750	13,490	45,840
Paddy Price	23	23	23

Note: Prices used to formulate this table are preliminary.

Table 9. Coastal Lowlands: Comparative costs and returns of single transplant rice producers on a hectare basis, using traditional and improved technology - 1968 prices.

	Local varieties		
	Traditional technology	Improved technology	TN varieties
	VN$		
Costs			
Land preparation	4,375	4,375	4,375
Labor	13,670	15,090	16,130
Seed	1,125	1,125	1,125
Insecticide	-	3,600	3,600
Fertilizer	-	3,700	5,280
Rent on land	7,125	10,000	16,875
Interest	1,200	1,840	2,000
Total cost	27,495	39,730	49,385
Cost per kilogram (Paddy)	14.47	14.71	10.97
Returns (Gross)			
Paddy (MT)	1.90	2.70	4.50
VN$	47,500	67,500	112,500
Returns to Management	20,005	27,770	63,115
Paddy Price	25	25	25

Table 10. Coastal Lowlands: Comparative costs and returns of single transplant rice producers on a hectare basis, using traditional and improved technology - 1970 prices.

	Local varieties		
	Traditional technology	Improved technology	TN varieties
	VN$		
Costs			
Land preparation	10,800	10,800	10,800
Labor	17,760	19,910	21,420
Seed	1,440	1,440	1,440
Insecticide	-	4,980	4,980
Fertilizer	-	2,820	3,960
Rent on land	9,120	12,800	21,600
Interest	1,840	2,640	2,720
Total cost	40,960	55,390	66,920
Cost per kilogram (Paddy)	21.56	20.51	14.87
Returns (Gross)			
Paddy (MT)	1.90	2.70	4.50
VN$	60,800	86,400	144,000
Returns to Management	19,840	31,010	77,080
Paddy Price	32	32	32

Note: Prices used to formulate this table are preliminary.

Table 11. **Southern Region: Estimated cash outlays on per hectare basis for single transplant rice producers at selected foreign exchange rates on imported inputs - 1970 prices.**

	Local varieties		TN varieties	
	VN$118/US$1	VN$275/US$1	VN$118/US$1	VN$275/US$1
	VN$			
Cash Outlays	12,820	20,980	14,500	24,900
Labor and land preparation[1]	6,680	6,680	6,680	6,680
Insecticides	3,860	8,990	3,860	8,990
Fertilizer	2,280	5,310	3,960	9,230
Other Costs	33,490	33,490	43,160	43,160
Total	46,310	54,470	57,660	68,060
Costs per Kilogram of Paddy	17.81	20.95	12.81	15.12
Marginal Returns to Fertilizer[2]	4.54	1.94	7.00	3.00

Note: 1970 prices are preliminary.

[1] Forty percent of land preparation cost and 120 MWD for transplanting.

[2] This represents the marginal returns over marginal costs assuming fertilizer application at the mean rates indicated in charts 1A and 2A and assuming a farm price for paddy of VN$23 per kilogram. Fertilizer prices used were VN$12 at the VN$118 to US$1 and VN$28 at the VN$275 to US$1.

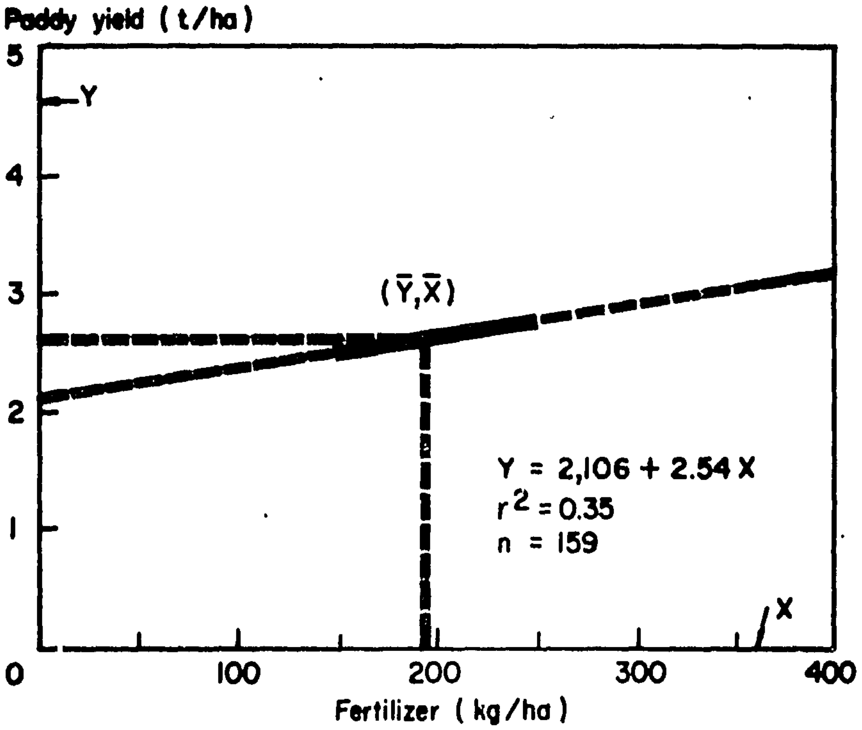
Table 12. Coastal Lowlands: Estimated cash outlays on per hectare basis at selected exchange rates on imported inputs - 1970 prices.

	Local varieties		TN varieties	
	VN$118/US$1	VN$275/US$1	VN$118/US$1	VN$275/US$1
Cash Outlays	15,720	26,090	16,860	28,750
Labor and land preparation[1/]	7,920	7,920	7,920	7,920
Insecticides	4,980	11,600	4,980	11,600
Fertilizer	2,820	6,570	3,960	9,230
Other Costs	39,670	39,670	50,060	50,060
Total Costs	55,390	65,760	66,920	78,810
Costs per Kilogram of Paddy	20.51	24.35	14.87	17.51
Marginal Returns to Paddy[2/]	6.77	2.90	9.73	4.17

Note: 1970 prices are preliminary

1/ Forty percent of land preparation costs and 18 MWD for transplanting.

2/ This represents the marginal returns over marginal costs assuming fertilizer application at the mean rates indicated in charts 1A and 2A and assuming a farm price for paddy of VN$32 per kilogram. Fertilizer prices used were VN$12 at the exchange rate of VN$118 to US$1 and VN$28 at the exchange rate of VN$275 to US$1.



(50 percent urea and 50 percent 16-16-8)

Chart: 1 A. Traditional rice variety fertilizer response, 1968/69 crop.

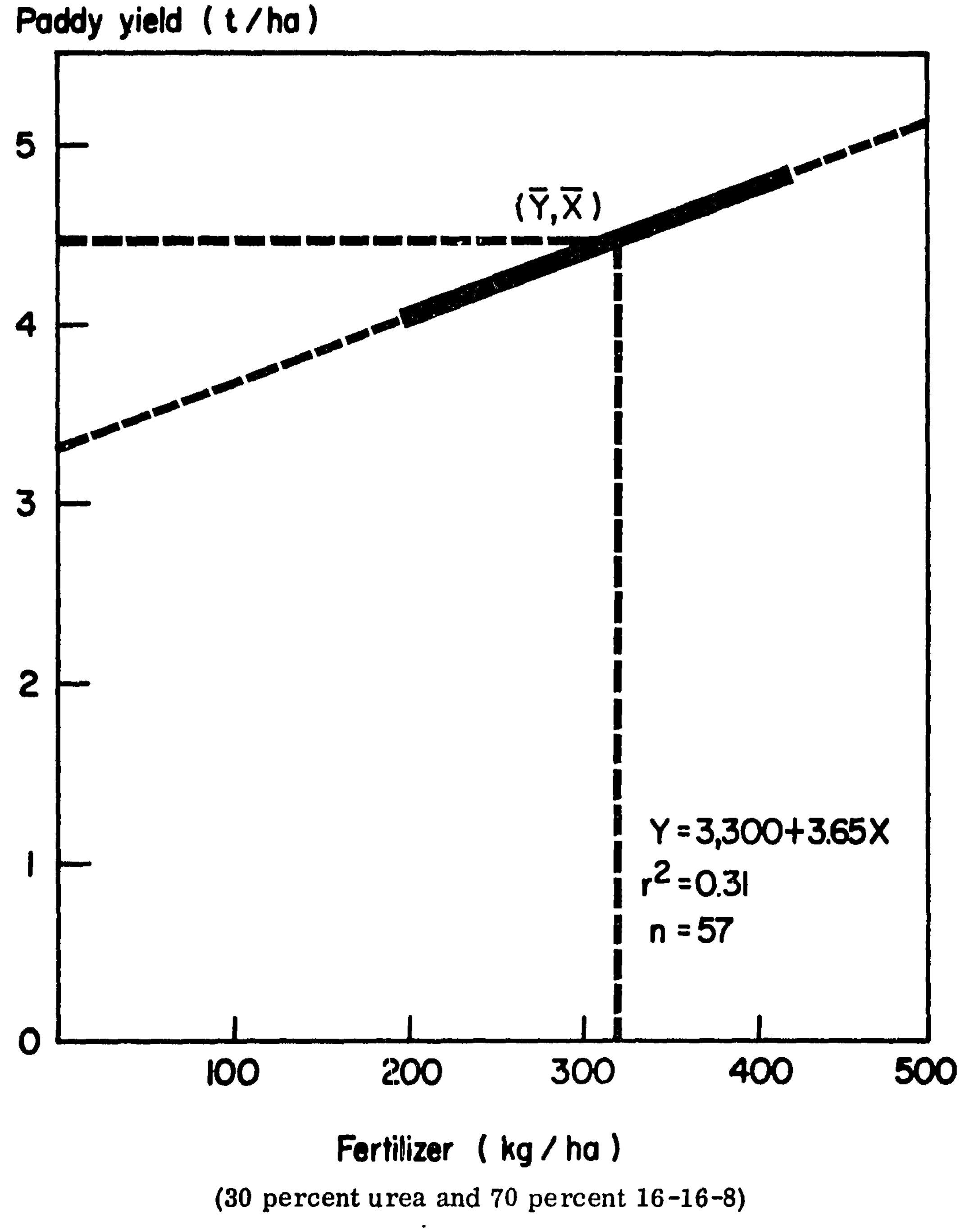


Chart: 2 A. TN rice variety fertilizer response, 1968/69 and 1970/71 crop.

AGRICULTURAL AND TRADE DEVELOPMENTS IN THE LDC's: IMPLICATIONS FOR THE UNITED STATES *

Willard W. Cochrane **

I

As the title suggests, we will be concerned in this paper with agricultural and trade developments in the Less Developed Countries (LDC's), and the implications of those developments for the welfare of farmers and consumers in the United States. In thinking about the agricultural development problems of the LDC's, I am increasingly convinced of the obvious, namely, that resource endowments of the LDC's vary tremendously. As a consequence, the agricultural development process and the trade potential of LDC's must differ markedly. In this paper, then, we will divide the LDC's into two major groupings: those for which the pressure of population on land and water resources is great, hence, the land/man ratio is low; and those for which the pressure of population on land and water resources is considerably less, hence, the land/man ratio is relatively high. And we will analyze agricultural and trade developments over the past decade, and the decade ahead, in each of these groupings.

Once we have reached some conclusions regarding agricultural development and trade potentials of the above groupings, we will consider the implications of those developments specifically for the United States. Finally, we will consider the response of the United States to such developments. In this connection, we will give some attention to both the probable response of the United States, and what ought to be its response. Let us, then, proceed immediately to an analysis of the first grouping of the LDC's.

II

The countries of Asia uniformally have a low land/man ratio, where by "land" we mean the available cultivated land and potentially arable land, and by "man" we mean the total population of the country or region. As of 1965, the acres of cultivated land and potentially arable land per person was 1.5 acres for the continent of Asia. 1/ Important increases in agricultural production for the countries of Asia, thus, cannot take place through extensive developments. They must occur through intensive developments on the existing cultivated land and the very limited potentially arable land. Increased agricultural production in the LDC's of Asia must occur through improved water control and management, the increased application of nonfarm produced inputs and the transformation of farming operations from a traditional state to a modern, scientific state, all of which operate to increase output per acre cultivated. And this is what is happening over wide reaches of the Asian sub-continent and in limited enclaves in Southeast and East Asia. It is what we are now calling the Green Revolution. This is perhaps a bad term, since it implies that more is happening over a wider area than really is the case. But it is important to recognize that the principal components of the Green Revolution - high yielding plant varieties, water, fertilizer and plant protection - which had their origin in Japan and Mexico, are now finding their greatest application in South and Southeast Asia.

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The dramatic production developments in Asian agriculture, which seemed to burst across the developing world in 1967-68, but which had really been in the research and development pipeline for a decade, may be usefully broken into three categories. First, the new dwarf varieties of wheat, in combination with water, fertilizer and pesticides, have enabled farmers adopting the new wheats in Pakistan, India and a few other countries to double their production of wheat in those areas with ready access to water. Second, the new dwarf varieties of rice have been adopted by farmers more slowly than wheat, hence, they have less dramatic impact on total output for several reasons: (a) the new rices are more demanding with regard to water management than the new wheats, (b) for numerous reasons (e.g., lack of water management, disease problems) the yield increases have been less dramatic than for wheat, and (c) consumer acceptance of the new rices has not been good in many cases. Nonetheless, solid and steady gains in the research, development and adoption of the new rice varieties have been made. We can expect continued and significant increases in rice production in the hot, wet regions of the world. Third, a wide variety of production developments are occurring throughout the developing world in such diverse commodity areas as marize, mushrooms, potatoes, grapes, and dairying. These production developments are so varied that it is difficult to find a good term to describe them, but they are based on the spirit of science and modernization that is sweeping across the agricultural economies of Asia, and they often reflect a spirit of enterprise which in the past has been lacking in the LDC's.

Further, there is no reason to believe that the dramatic production developments in Asian agriculture of the past five years are likely to phase out in the 1970's. On the contrary, continuous breeding programs in rice and continued efforts to improve the management of water on paddy fields suggests to me that paddy yields will increase throughout the 1970's, with significant increases occurring in rice production in many Asian countries.

The search for and development of new crops is playing an important role too. Ten years ago potatoes were rarely produced in India, now potatoes are grown widely across Northern India in the winter season. Similarly, grapes, apples, maize and soybeans are being produced more widely in India; and often with spectacular success. These and other crops in conjunction with the high yielding wheats and rices are contributing importantly to increases in aggregate farm output through the practice of multiple cropping.

Lester Brown makes the following important point with regard to the practice of multiple cropping. 2/

The genetic characteristics of the new varieties - high yields, early maturity, and reduced sensitivity to day-length - are opening new vistas for multiple cropping. Farming around the calendar with two, three, and occasionally even four crops per year is becoming feasible in the tropics and subtropics, wherever water is available for irrigation. Historically tied to the monsoon or rainy season, agriculture in these regions is developing a new rhythm; farmers are beginning to discover the potential for expanding food production during the dry, sunny season. Data from both Indonesia and the Philippines show higher yields in the dry season than in the rainy season for four high yielding varieties grown at several different sites. Although environmental conditions varied widely among the sites, dry-season yields were consistently higher, averaging 52 percent above those obtained during the rainy season. The potential of multiple cropping is suggested by the performance of Taiwanese farmers who expanded the area producing multiple crops from 18 percent in 1946 to 89 percent in 1966. By 1969, they were harvesting an average of two crops per year on all cropland in Taiwan.

From the production developments briefly described above, most LDC's in Asia are currently experiencing a growth rate in agricultural production of 2.5 percent per year or more. Several have growth rates exceeding four percent per year - for example, Thailand and Taiwan. 3/ By United States standards, or any standards, for that matter, this is an outstanding record. But the LDC's in Asia are not as yet flooding the world market with agricultural surpluses, as are the developed countries of the West. They are not, because in most cases the demand for agricultural products is increasing more rapidly in those countries than is production.

Let us explore this relationship in more detail. There are a number of LDC's in Asia, found mostly in West Asia, in which population growth is equal to, or exceeds, the rate of increase in agricultural production. These countries are growing both in terms of population and agricultural production, but they are not developing economically in that the per capita availability of agricultural products is holding constant, or declining. Happily, most LDC's in Asia are experiencing a rate of increase in agricultural production which exceeds population growth; but because of rising incomes and the resultant increase in the per capita demand for agricultural products, the rate of increase in total demand exceeds the rate of increase in production. Thus, although these countries are making good progress in the development and modernization of their agricultural plants, and are having some success in increasing the per capita availability of food supplies, they continue to experience food problems because: (a) total demand exceeds supplies, and (b) the extreme inequality in incomes, in which a fourth to a half of the population cannot afford a diet that is adequate even in calories. India is a case in point. Finally, there are a few Asian countries that are on the brink of a production surplus for food grains

(West Pakistan, for example), or that have achieved such a satisfactory state of overall economic development that they have become important exporters of certain specialty products (mushrooms from Taiwan, for example).

Now, the question before us is the following. As agricultural development continues to occur in the 1970's, along the intensification route outlined above, how are the production fruits of that development likely to be distributed? Will more Asian LDC's become intermittent grain exporters as now is the case with West Pakistan? Or will some countries follow the Taiwanian example and seek to export high-income elasticity agricultural products? Or will most Asian countries look inward and try to improve the economic lot of the masses of people living in extreme poverty in those countries? Or will something else occur?

First, it should be recognized that if LDC's in Asia become involved in civil wars and internal strife such as we have witnessed in Cambodia, Laos and Vietnam over the past decade, and as we are currently witnessing in Pakistan, those countries are not going to enjoy rapid and sustained agricultural development. In this connection, the Green Revolution could itself lead to social and political revolution in those countries, where the production gains from that production revolution are distributed in a highly inequitous manner. In a sense, this is what is occurring in Pakistan; the agricultural sector of West Pakistan has developed in a spectacular fashion, whereas agricultural development in East Pakistan has lagged badly. This fact added to certain other grievances, including racial differences, has touched off a civil war. We can expect more of this in the LDC's where one region, or one social class, benefits directly and importantly from the agricultural development process, and other regions or social classes fail to prosper. This kind of uneven development and unequal distribution of the fruits of development could easily choke off and destroy the development process in certain Asian countries over the next decade.

But assuming that the political and social processes support and facilitate the adoption of new and improved production technologies in agriculture, and further speed the rate of output increase, how will the surplus product be distributed? Given the existing and physical marketing machinery, including transport facilities, in these countries and the need to earn foreign exchange through increased merchandise exports, a powerful tendency exists to move grain surpluses, over and above absolute minimum needs, into export. Hence, I expect countries like India and West Pakistan, to become intermittent grain exporters as quickly as possible and to the greatest extent possible in the 1970's.

Countering the drive for commercial grain export, is the urgent need to improve the lot of millions and millions of the poorest of the poor in these countries through increasing their consumption of food. Professors Dandekar and Rath in their path breaking study of poverty in India estimate, for example, that 40 percent of the rural population and 50 percent of the urban population in India in 1960-61 lived in such poverty that they could not afford to purchase sufficient food to provide them with an adequate diet with respect to calories. 4/ And poverty amongst the urban population has deepened and widened since 1960-61, with the extent of poverty holding about constant in the rural population. If public works programs, or special food programs, were designed and placed in operation to reach the nearly 50 percent of the Indian population living in poverty, and to raise their consumption of food to a level of adequacy, the prospective grain surpluses of the next several decades would melt like snow on a May day on the dustry plains of Northern India. But public works programs designed to raise the daily incomes of more than 200 million people, or special food programs designed to reach that number, would be terribly costly and place a huge drain on the treasury of the Government of India. Thus, India and other Asian countries with great masses living in poverty are likely to move cautiously with respect to such programs. In my judgement, governments of Asian LDC's will nibble on their respective poverty problems during the coming decade, and take such actions as are required to maintain social tranquility and political stability, but little more. And they will seek wherever possible to move short-run market surpluses of grain into the export market. By such a policy they improve their budget position, rather than make necessary the imposition of a sharply progressive income tax.

Asian LDC's are not, however, tied to food grains, or to such traditional exports as tea, oil seeds and hard fibers. Agricultural development in the past two decades has opened up numerous opportunities for Asian LDC's to move into the production and export of non-traditional products.

Thailand, a leading rice exporter for decades, has watched the spread of the Green Revolution with fear and trepidation and has felt its first harsh consequences in the form of a decline in rice exports prices of some 25 to 30 percent. Fortunately for Thailand, some farmers, businessmen and research workers began to experiment with maize production in the early 1950's. The production of maize increased rapidly in the upland areas of Thailand, enabling maize exports to increase by 30 percent per year (compared with a 1.4 percent increase for rice, for example) from the middle 1950's to the middle 1960's. By 1965, maize had become Thailand's fourth largest export commodity. Thailand discovered a non-traditional agricultural commodity - maize - which it could produce efficiently and for which the foreign demand was increasing rapidly (particularly in Japan), and it has come to enjoy an expanding export trade in that commodity. Currently the government of Thailand is attempting to develop a swine industry, which at this infant stage, is making modest progress. Promoters of hog production expect first to export live animals to Singapore and Hong Kong, and second to develop a meat packing industry. And currently there is considerable talk among research workers and economic planners of producing vegetables as a second crop after rice, process some or all of these vegetables and export canned vegetables to the markets such as Japan and Hong Kong.

Similarly, Taiwan has de-emphasized sugarcane production, held the acreage devoted to rice about constant, and diversified its agriculture. Acreages devoted to vegetables, peanuts, soybeans, tobacco and fruits have increased importantly in the past two decades. Three non-traditional export commodities have become important foreign exchange earners in recent years; they are mushrooms, canned asparagus, and plywood. It could be said that Taiwan has become the mushroom capital of the world in the 1960's.

True, every developing country cannot turn to mushrooms. But, every LDC can look for commodities with a high-income elasticity, which it can produce efficiently, and then explore the possibilities of exporting those commodities to rapidly developing areas like Japan, Western Europe and North America. So long as the economies of the developed countries continue to grow there will be a strong demand for maize and soybeans out of which to produce meat, for meat products themselves, and for specialty items like canned vegetables, fruits and nuts. The best hope for many an LDC to increase its export earnings from agriculturally related industries in the decades ahead, is to turn to the non-traditional commodities with high-income elasticities.

In sum, through research and development, the increased application of nonfarm purchased inputs, and more intensive farm operations, a revolution in the production of food grains and many other commodities is occurring throughout South and East Asia. Research developments, technologies currently available and investment plans suggest that this production revolution in agriculture will continue throughout the next decade or two. In this event, a rate of output expansion in agriculture of 3 or 4 percent per year could be the norm.

Whether these rates of output expansion will be achieved in fact will depend upon the success of these countries in achieving internal political and social stability. And on this point I do not have the answer; I am optimistic one day and pessimistic the next. But assuming sufficient internal peace and tranquility to permit and facilitate the achievement of rates of agricultural output expansion of 3 or 4 percent per year, we can expect the LDC's from Asia to become more active exporters of food grains and a variety of non-traditional agricultural exports (e.g., feed grains, swine, canned fruits). These new exports of wheat and rice will tend to be of low commercial quality, and come onto the market in a rush. Thus, these exports will have a de-stabilizing influence on the world grain market - perhaps at times a chaotic effect.

Such adverse effects on the world grain market would be reduced, perhaps even eliminated, if the countries involved would make a serious effort to achieve a more equitable distribution of agricultural production gains within their own populations. And we can hope that this will occur; perhaps even help to make it occur. But poverty is so ubiquitous in these countries that extraordinary measures, involving significant redistributions of income, will be required to effect a tangible improvement in the lot of the masses living in poverty, including a discreet jump in their food consumption. It could be done. And it may be done to avert political chaos and civil war. But I am inclined to doubt that it will be done short of violent internal strife. Thus, as you see, I oscillate back and forth between great production gains and exportable surpluses, and internal political strife and social upheavals, which will choke off the agricultural production developments that are technically possible.

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III

The LDC's of Latin America and Africa are typically high land/man ratio countries. The acres of cultivated and potentially arable land per person in Latin America is 9.5; the acres of cultivated and potentially arable land per person in Africa is 7.1. The LDC's of Latin America are poor and economically backward, but they do not suffer grinding poverty by the masses as do the LDC's of South and East Asia. Further, the LDC's of Latin America and Africa typically have an option open to them that is not open to Asian LDC's, namely, increasing aggregate agricultural output through bringing new land into cultivation. In other words, extensive agricultural development has been, and will continue for an indefinite period, to be an important, if not the dominant, source of production increases in these countries.

It is important to recognize that these are extreme differences in the wealth, or income, position of countries falling in this high land/man ratio category. For example, the per capita Gross Domestic Product (GDP) for the period 1955-67 for countries in Latin America ranged from $935 per year in Venezuela and $758 per year in Argentina to $176 in Bolivia and $79 in Hati. The same extreme differences in wealth, or income, position are to be found in Africa too. For example, per capita GDP for the period 1955-67 for LDC's in Africa ranged from $1,062 for Libia to $50 for Malawi and $44 for Upper Volta. In fact, there may be a question whether Argentina is really an LDC; in my opinion, it is a developed country suffering from a prolonged period of economic stagnation. And the white settlements in Kenya and Rhodesia and the French in Algeria, with ready access to European capital and technology, certainly placed those countries, at one time at least, in a different position than most LDC's in the same areas.

The LDC's in Latin America and Africa also exhibit a wider range in the average annual growth of agricultural production than do the LDC's of the Far East (see the range in production growth rates in Figure 1).[5] For the period 1952-69 four LDC's in Latin America had growth rates in agricultural production that exceeded five percent per year (Ecuador, Venezuela, Nicaragua and Mexico). And the growth rates of five Latin American countries exceeded the LDC with the highest growth rate in the Far East, Thailand. At the other end of the scale, four LDC's in Latin America had growth rates in agricultural production of less than one percent per year (Cuba, Barbados, Hati, Uruguay), and Argentina could muster a growth rate in agricultural production of only 1.5 percent per year. Similarly, we find the same extreme range in the rate of growth in agricultural production in Africa. Two countries, Ivory Coast and Upper Volta, had growth rates for the period 1952-69 that exceeded 5.5 percent per year; three countries, Algeria, the Congo and Botswana, had negative growth rates, and Tunisia limped along with a rate of 0.2 percent per year.

Given the fact that most LDC's in this category could increase agricultural output (1) by intensifying farming operations on existing cultivated areas, and (2) by bringing new land under cultivation, why are some of these countries able to develop their agricultural economies at a fantastically rapid pace, and others fail completely? Obviously there is no easy, general answer to this question which can be put to use to speed up development in the lagging LDC's. But some observations are in order, which are helpful in thinking about the problem. Most of the countries that achieved high rates of increase in agricultural production in this high land/man ratio category of countries did so through an expansion in their agricultural plants - by bringing new land under cultivation. Brazil, for example, which achieved a rate of increase in agricultural production of 3.7 percent per year over the period 1952-69 did so almost exclusively through extensification. Loius Herrmann writes as follows with regard to Brazil. ".... Less than 1 percent of the 6 million hectares in the frontier states was in crops in 1960, compared with 10 percent of the 2.5 million hectares in the settled states. It is not surprising, then, that Brazil's agricultural growth from 1947 to 1965 came mainly from increases in cropland."[6]

A few other countries, such as Mexico, were able to marshall a total development effort involving: (1) increased area under crops, (2) increased fixed and working capital invested per acre, (3) new and improved technologies adapted to the area, and (4) a favorable economic climate and stable government. This is an exceedingly difficult development package to put together, and only a few LDC's have succeeded in doing so, but when they do agricultural production soars. There is another route to successful agricultural development, which a few LDC's have discovered; it is to seek out and find a high-income elasticity agricultural product, which complements the agricultural economy of certain developed nations, hence, does not encounter formidable import barriers, and may be produced efficiently in the LDC in question. Ecuador has found such as commodity in bananas; it has achieved a growth rate in its agricultural production of 6.3 percent per year based primarily on one commodity, bananas. So it can be done, but to borrow a phrase "it ain't easy".

The LDC's in this category of countries with the poorest production records have ready, almost easy explanations. Almost without exception they have suffered from wars of independence, civil wars, serious internal strife and highly unstable governments. In this political climate significant and sustained agricultural development was, and in some cases continues to be, impossible. Countries such as Argentina and Chile, Dahomey, Chad and Guinea, besides suffering from poor and arbitrary governmental management, have been handicapped by various other factors. In some cases governmental pricing policies have operated as a dis-incentive to agricultural production (Argentina is the classic case in point). In more cases, inadequately financed policies, poorly administered policies, or no policies at all, have resulted in the failure to develop a necessary transport system, to develop the necessary new and improved technologies adapted to the area, to provide the necessary production input (e.g. fertilizer and pesticides) to provide the necessary production credit, to begin to control and efficiently manage water supplies, and on and on. Without these components a modern, productive agriculture cannot be established, even where new land is available to be brought under cultivation. Hence, when and where they are not provided, or are provided in minimal amounts, agricultural development proceeds at a slow pace.

Are there forces at work which will operate to reduce the extreme range in rates of growth in agricultural production, and tend to concentrate LDC's from Latin America and Africa in a high level band of say from 3 to 5 percent increase per year? I think not. I see no reason to believe that governments in this category of LDC's will be more stable and less arbitrary in the next 20 years than in the last. Revolution, internal strife and the coming and going of military dictators will be the norm for many, if not most, of these countries for a long time to come, none of which is conducive to economic development.

Improvements in transport, electric power and water management will come slowly because of the large investment costs involved, and the pay-off from research and development in the form of new and improved technologies in agriculture we have learned over and over again takes time, often a very long time. Thus, I would expect that rates of growth in agricultural production, as a general pattern, will continue pretty much as they have in the past. But this in itself does not represent failure. The modal countries in this category of LDC's are increasing their total output from agriculture by 2 to 4 percent per year, and, as we have already noted, a few exceptional countries are exceeding 5 percent per year.

We should, however, expect some shift in the country pattern of growth rates. I do not believe, for example, that Ecuador can maintain a growth rate of 6.3 per year on bananas alone; limits to the size of the market and external competition are likely to place some brakes on this growth rate. On the other hand, the sleeping giant, Argentina, must awaken some day and start producing agricultural products more nearly in line with its resource endowments. And Brazil could well be the next country to make it big in terms of total economic development.

In Africa anything can happen. But in the long run I certainly do not expect Algeria to have a negative rate of growth in agricultural production, and for Upper Volta to sustain a rate of 5.7 percent per year, however, it may have achieved that rate between 1952 and 1969.

Bearing in mind the agricultural development facts and relationships discussed above, what are the agricultural trade prospects for this category of LDC's over the next decade or two? There is no reason to expect any diminution in the rate of increase in the production and export of tropical products from these countries. They have experience with these products and know how to produce them; they have new lands which can be devoted to their production; they have need for the foreign exchange earnings; and tropical products typically do not encounter prohibitive import restrictions in developed countries. Thus, we can expect this group of countries to continue to expand the production of tropical products - probably expanding production to the point where total supplies are pressing against world market demand and chronically depressing world prices. Perhaps these countries will have some success in regulating world supplies through international commodity arrangements, as they seem to be currently having with respect to coffee; but, as an old supply manager, I have my doubts.

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In the area of competitive agricultural products - the grains, livestock, oil seeds, and non-tropical fruits and vegetables - almost anything may happen with respect to exports from the LDC's of Latin America and Africa. Both Mexico and Brazil, for example, increased their production of feed grains (primarily maize), sufficiently in the 1960's to become exporters of feed grains by the end of the decade. And we should expect feed grains from these two countries to increase further in the 1970's, since both countries have put together a highly successful development package for agriculture. But the world market for feed grains is expected by some to expand so greatly during the decade of the 1970's, that exports of feed grains from Mexico and Brazil will be dwarfed by the larger developments. The authors of the publication Growth in World Demand for Feed Grains argue, for example, that 7/

> From a net export position of 5 million tons in 1965, the less developed countries as a group appear destined to become net importers of at least this amount, /of feed grain/, if present per capita levels of meat consumption are not to be reduced. They would import even larger amounts if expected relationships to income growth hold and no change is made is present production policies in some less developed countries. Exports of some less developed countries (LDC's) are projected to increase, and the United States should continue through 1980 to lead the world in net exports of coarse grain.
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> Less developed countries are expected to feed their livestock 65 million tons of grain in 1980; central plan countries, 150 million tons; and developed countries, over 300 million tons. These figures imply more than doubling the use of feed grain inless developed countries, 65 percent expansion in central plan countries, and 51 percent growth in developed countries.

I would argue as follows, then, with regard to the export trade of LDC's from Latin America and Africa in the competitive product category. Some startling developments may occur in certain LDC's in this category, but it is difficult to predict when and where. Such agricultural developments may be large relative to the production capacity of the LDC's in question, and lead to high rates of growth in the production of competitive products, but such developments and such rates of growth will be small relative to the world demand for the products involved. Thus, with one or two possible exceptions, we would not expect increases in the production and export of competitive products from these LDC's to play an important role in the world trade picture. And if they play an important role, it will be principally in denying the developed countries an increasing role in supplying the market for grains and livestock products in those LDC's, as the demand for meat and animal products increases with increased general economic development.

Two countries in Latin America, Argentina and Brazil, could prove to be the exception to the above generalization. Both of these countries have the potential of greatly increasing their domestic production and export of

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food grains, feed grains and livestock products. The production potential is there; the potential volume of grain and livestock exports from these countries could significantly influence world trade in these commodities in the 1970's and 1980's. But whether these two countries will formulate the policies and organize their productive resources in a manner that will enable them to realize their potential remains to be seen.

IV

What are the implications of the foregoing developments for the United States? First, as a direct result of the Green Revolution, P.L. 480 exports of wheat have just about been cut in half over the past four years.

Second, wheat production developments in the LDC's are likely to reduce P.L. 480 exports of wheat to a trickle by the end of the 1970's.

Third, wheat production developments in certain LDC's are likely to result in those LDC's becoming intermittent exporters of wheat in the 1970's. Such exports will come onto the market with a rush when they come, be of low commercial quality and cause prices to fall sharply when they hit a thin world commercial market.

Fourth, developments with respect to the production of rice in Asian LDC's have progressed more slowly than with respect to wheat. Nonetheless, there is reason to believe that paddy yields per acre and rice production in the aggregate will increase importantly in the 1970's and 1980's. In this event, we can expect P.L. 480 shipments of rice to Asian LDC's to wither away in the 1970's.

Fifth, given the expected increase in the demand for meat, and the feed grains to produce that meat, in the less developed world in the 1970's, it seems improbable that the LDC's in the aggregate will become a net exporter of livestock products and feed grains in the 1970's and 1980's. There is always the possibility, however, that countries such as Argentina and Brazil will become sufficiently larger producers, and exporters, of meats and feed grains to become formidable trading competitors of the United States.

There is a high probability, then, that the loss of export markets for wheat and rice, and low and chaotic prices in world markets, will force wheat and rice producers in the United States to undergo some significant production adjustments. In the first instance, producers of those commodities may wish to consider further reductions in production through control programs. But in the intermediate run there will be a strong pressure to shift wheat producing resources into feed grains, and rice producing resources into soybeans, cotton, feed grains and vegetable crops. Thus, through the process of substitution the impact of the loss of export markets for wheat and rice will be transferred through the farm economy. In the long run, lower grain prices generally may force some wheat producing areas into grass and extensive cow-calf operations. Finally, although not a probability, it is possible

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that American farmers may face stiffer competition in feed grain markets abroad from certain African and Latin American LDC's in the 1970's and 1980's.

In sum, the 15 year long period of foreign surplus disposal of food grains seems to be coming to an end, and the competition for commercial export markets for food grains seem certain to become more intense. The feed grain export picture is generally bright, with only a dark cloud or two on the distant horizon.

But it is important to recognize that agriculture development in the LDC's will bring new export opportunities to the United States and other industrial nations. Sustained agricultural developments in those countries will require a large and continued inflow of all kinds of agriculturally related capital inputs: electric motors, tube well and water pipe, construction steel, trucks, railway cars, fertilizer, fertilizer factory construction materials, tin plate, copper wire, road building equipment, machine tools and on and on. As an economically advanced country, the United States has a technical superiority in the production of many of the above products, and it should expect to increase its exports to the LDC's in those high-valued product lines. This is what development is all about - the adjustment in each country (DC and LDC) wherein resources shift out of low productivity lines and into higher productivity lines. In India this may mean shifting away from single-crop monsoon paddy production to multi-crop production involving high yielding varieties; in the United States this may mean shifting out of rice and wheat production and into soybean and beef carcass production, or into assembly line housing construction and wood products production. In this context, we trade where it is mutually advantageous to do so. Then we adjust some more - in a never ending process that brings both gains and losses, joy and sorrow. But if development is occurring for the countries involved, the real income gains will outweigh the losses.

V

How will the farmers of the United States, their spokesmen and concerned governmental agencies react to the foregoing developments? Without strong and wise leadership they (the farmers and the concerned government agencies) are likely to react in a highly negative way. Wheat and rice farmers will resent the loss of their P.L. 480 markets, and they will seek to avoid the production adjustments that follow as a consequence.

Given the history of agrarian discontent in the United States and the response of government to it, it is logical to expect that wheat and rice farmers will petition the government for increased income support, temporary production controls and subsidized export measures designed to expand sales in the international commercial market. It is also possible that farmers will use their political influence to further curtail foreign economic and technical assistance. The wheat and rice farmers hit by the loss of P.L. 480 markets are likely to cry out "to hell with our downtrodden neighbors".

But let us hope that strong and wise leadership at the national level will have made itself felt before we reach the special interest panic point. Clearly our national interest in satisfactory development and stable governments in the less developed world transcends the possible adverse repercussions of the Green Revolution on American grain producers. First, as noted above, successful economic development in the less developed world means an expansion in foreign markets for high valued fabricated products in the United States. Second, the maintenance of stable governments and the avoidance of internal strife and civil wars in the LDC's is vital to the international political interests of the United States. Internal strife and civil wars invite political adventuring by third countries and lead to international confrontations. Thus, it is in the economic and political interests of the United States to assist and support sustained economic development and stable non-aggresive governments in as many LDC's as possible; certainly not to take actions that are intended to weaken them.

What actions, then, should the United States take to assist and re-enforce the important agricultural developments, as a part of total economic development, that are underway in the less developed world? First, the United States must be prepared to make some permanent downward adjustments in the production of wheat and rice - commodities that have lived on foreign surplus disposal for nearly two decades; most certainly it should not succumb to new and more aggresive export subsidy schemes for those commodities.

Second, we must not weaken our foreign aid program. On the contrary, our foreign aid program should be expanded in terms of total assistance and be improved in quality. In this connection our aid program might well be concerned with assisting LDC's to use the fruits of the Green Revolution internally to improve food consumption levels in those countries.

Third, the United States should take steps to reduce tariff barriers on processed and semi-processed primary products from the LDC's. The effective tariff rates on processed primary products in almost all developed countries, including the U.S., is stifling industrial development in the LDC's. Perhaps the United States could take the initiative in convening a United Nations Conference on Trade and Development (UNCTAD), which would concern itself with lowering of the very high effective tariff rates on processed primary products in the developed countries in return for improved conditions and less arbitrary rules governing the investment of private capital in the LDC's.

Fourth, the United States should consider extending trade preferences to LDC's on general basis, if possible (i.e., in concert with all other developed countries). But if that fails, which seems likely at present, then it should consider extending trade preferences to all nonaligned LDC's on a unilateral basis. The product coverage of such a preference scheme cannot be detailed here, but it must be sufficiently wide to assist in a significant way with the industrial development of the LDC's.

In sum, there is much that the United States can do in furthering its self interest in the less developed world, if it would. The four courses of action outlined above indicate some important things that it could do. There is some pain involved in those courses of action. But if they were pursued vigorously under strong and wise national leadership, they could have some wonderfully beneficial results for the United States and the LDC's.

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FOOTNOTES

1/ Computed from data in The World Food Problem, A report of the President's Science Advisory Committee, Volume II, the White House, May 1967, Tables 7-9, p. 434. The ratio of 1.5 for Asia compares with 30.0 for Australia and New Zealand, 6.8 for North America, 9.5 for Latin America, and 7.1 for Africa.

2/ The Social Impact of the Green Revolution, published by the Carnegie Endowment for International Peace, January 1971, No. 581, p. 11.

3/ Economic Progress of Agriculture in Developing Nations, 1950-68, Foreign Agricultural Economic Report, No. 59, ERS, USDA, Washington, D.C., May, 1970, p. 11. The production data in this report differs in some degree from production data presented in The State of Food and Agriculture 1970, FAO, Rome, 1970. In the FAO report, for example, production increases for Taiwan fall to 3.9 percent per year, but the central point is not changed.

4/ Poverty in India, Indian School of Political Economy, Poona, January 1971. Available through The Ford Foundation, New Delhi, India.

5/ This figure is taken from The State of Food and Agriculture, 1970, FAO, Rome, 1970, p. 129.

6/ Economic Progress of Agriculture in Developing Nations, 1950-68, Foreign Agricultural Economic Report No. 59, Economic Research Service, USDA, Washington, D.C., May, 1970, p. 126.

7/ Donald W. Regier and O. Halbert Goolsby, Foreign Agricultural Economic Report No. 63, Economic Research Service, USDA, Washington, D.C., July, 1970, pp. x and xi.

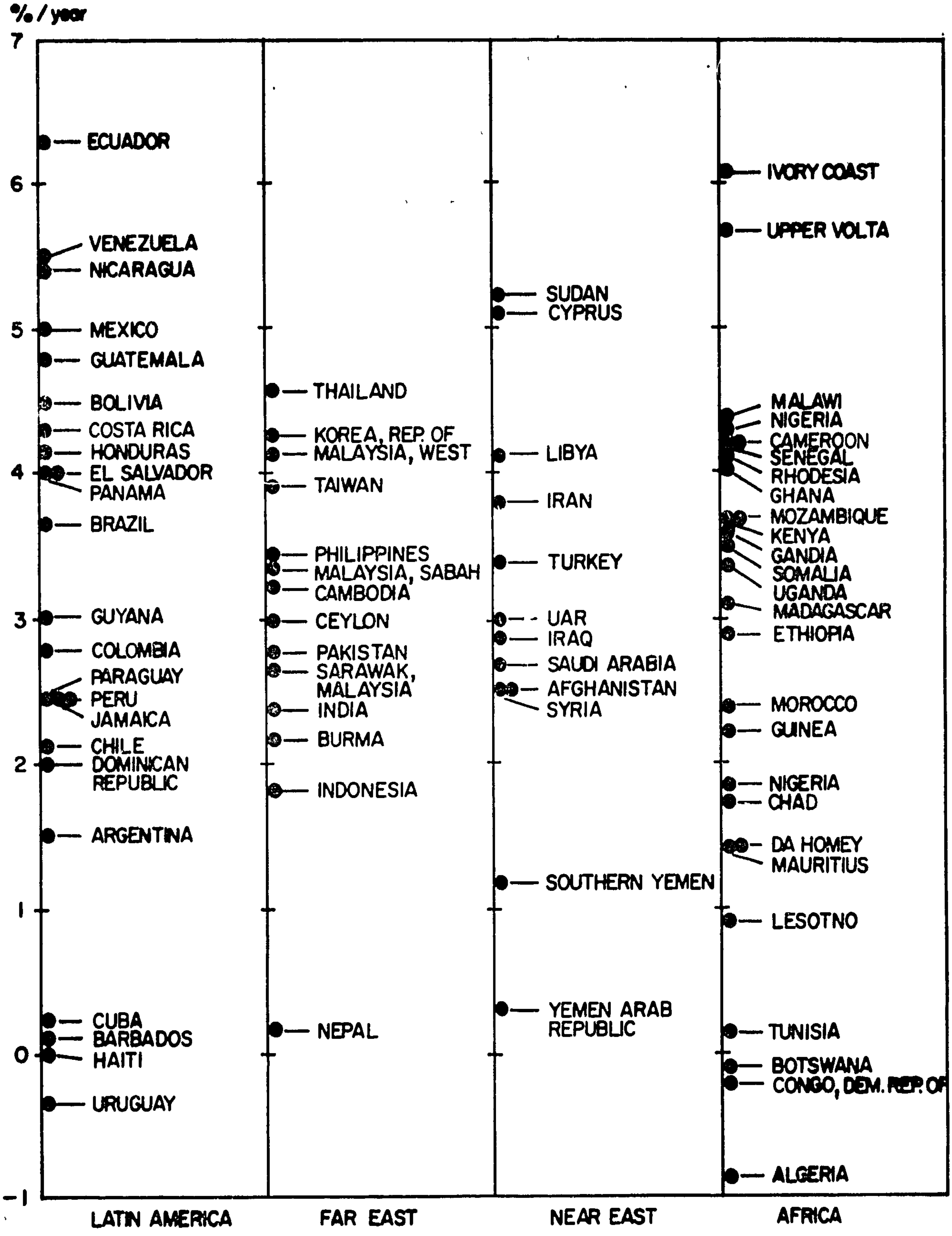

Fig. 1. Average annual growth of agricultural production in 75 developing countries, 1952-54 to 1967-69.